MUNICIPAL NEWS

Issued Monthly at Hammond, Ind.
by Gillette Publishing Company, formerly
Engineering and Contracting Publishing Company

Executive and Editorial Offices:
221 East 20th St., Chicago, Ill.
Address all communications to the above office.

HALBERT P. GILLETTE, President and Editor
E. S. GILLETTE, Secretary

C. T. MURRAY, Managing Editor

Cleveland Office, 1211 Swetland Bldg.: E. C. Kelly, Manager
New York Office, 420 Lexington Avenue: ERWIN T. EYLER, Eastern Manager

The specialized publishing plan of Gillette Publishing Company provides four monthly magazines at the subscription rates listed at the right.

Water Works	$2.00
Roads and Streets	2.00
Engineering and Contracting	2.00
Municipal News	2.00

Foreign Postage 65c Extra

All four may be subscribed for at the special rate of $5.00 a year, and thus taken they provide a service completely covering the construction field.

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Vol. LXXIV MARCH, 1928 No. 3

Why Is the Pacific Higher Than the Atlantic Ocean?

The ocean on our Pacific coast is 2 ft. higher than on our Atlantic coast. Why?

The prevailing winds and ocean currents are from west to east, and this would tend to pile up the water to a higher level on the west coast than on the east coast of the continent. But this answer only goes one step toward solving the riddle. Why are the prevailing air and ocean currents easterly in trend?

The earth rotates on its axis in an easterly direction, and it would seem natural that its atmosphere would rotate in the same direction but at a slower speed; in which case our prevailing winds would come from the east, which is not in accord with the fact.

When in 1883 Krakatoa exploded and sent its powdered rock up 20 miles or more, it was soon discovered that there is a current of air a few miles above the earth that moves with almost hurricane velocity (70 miles an hour) from west to east, constantly, for the dust travelled around the earth at that rate. This is a phenomenon that has not received adequate investigation, for it obviously must have a marked effect on our weather.

According to the etherite theory of self-propulsion of stellar bodies, the gradual exhaustion of the etherites from the electrons would reduce the centrifugal force and cause the bodies to move nearer to their center of revolution. They would describe a spiral ellipse, and not a closed ellipse; and as they near the center they would revolve faster. If the planets are composed of star dust ejected from sunspots, and if each planet was itself once a molten "sun" having sunspots from which its moons were ejected it follows that all space is occupied by star dust that is revolving about some center.

Since these particles are slowly approaching their center of revolution, some of them are constantly impinging upon the stellar bodies—suns and planets—and with a velocity greater than the rotative velocity of the stellar body. This not only would cause the stellar bodies to rotate on their axes, but to change their rate of rotation. The impact of star dust upon the air would give to the air a rotative velocity greater than that of the earth. This velocity should be greatest around the equator, according to this theory, for most of the original star dust emitted from the earth would be in a belt surrounding the equator. While we do not yet know the different rates of rotation of the air at different latitudes, we do know that the sun's atmosphere rotates fastest near the solar equator.

The eastwardly trend of the air would impart an eastwardly trend to the ocean beneath, and this would cause a higher level on our Pacific than on our Atlantic coast.

Robert W. Hume

For the third time since I engaged in the publishing business I have lost one of my closest associates; first in the death of Myron C. Clark, later in the death of Lewis S. Louer, and now in the death of Robert W. Hume. Differing as all men differ, they had in common one outstanding trait: They loved their fellow men. And in return they were loved by all who knew them well. What better can any man ask while he lives than to be surrounded by such friends as theirs? What better can he look forward to when his earthly end comes than that he shall never be forgotten by those friends?

Bob Hume was so dynamic, so full of whimsical humor, so effervescently optimistic, the personification of vitality, when last I saw him, that I can hardly realize that he is dead.

His was the rarest combination of great intellectual brilliancy and buoyant, lovable optimism. As a raconteur I have never heard his equal, for not only could he paint a vivid word picture in the best of language, but he could inject into it something of his own dynamic personality, which gave the picture a fascinating verve. He would have succeeded greatly as a writer, I believe. His letters indicate that, but his spoken words certainly proved his ability to charm and interest the listener.

Like Clark and Louer, Bob Hume endeared himself to all who knew him. His sympathetic interest in his fellow men won, in return, their interest in him. Yet he was no yes-yes man. He had most positive convictions and the courage to state them, even in the face of an opposition that might end in trouble. But he never failed to win respect for his convictions, because his sincerity was so pronounced as to be evident to every one.

H. P. Gillette

Maintenance of Fire Hydrants

Useful Suggestions Given in Paper Southwest Water Works Convention

By W. H. VAUGHN
Superintendent of Water Works, Fort Smith, Ark.

THE care and maintenance of fire hydrants is like almost all other mechanical processes which may have any relationship to civilization. It is a case of looking after little things, as many times the little things will develop into the big things.

The Need for Eternal Vigilance.—A fire hydrant is an appliance installed for the purpose of serving in an emergency. This should he borne in mind by those responsible for this service. One of the delegates in attendance here related an incident which shows the necessity of eternal vigilance to see that this service is as it should be. The story is that a fire hydrant was struck by a truck or some other vehicle, and having been set in gravel and earth, the top was broken off entirely, but whoever did the damage replaced the earth about the hydrant, and to the appearance of the casual observer, it was ready to operate. An inspection revealed the fact that the hydrant was broken below the top of the ground and was impossible to use. Periodical inspection revealed the condition.

We have one condition in Fort Smith which is detrimental to some extent, which is that some of our hydrants open to the right and some open to the left. We have some hydrants on 4-in. mains, and as in some cities, we have some hydrants of ancient design.

Location of Fire Hydrants.—We have a great many streets running at acute angles with other streets. We have some prominent intersections where six thoroughfares come together. But where possible, I think the practice should be universal of getting hydrants back a distance of approximately 12 ft. from the property line and 18 in. from the curb. They also should be at least 12 ft. away from any telegraph or trolley pole.

An important feature which is becoming more generally practiced is the installation of gate valves controlling each hydrant.

The hydrant makers are keeping abreast with the times in the appliances which they are offering on the market. There are many hydrants on the market where a damaged valve can be replaced in a few minutes. Some are so constructed that nothing can lodge in the region of or on the valve seat which could prevent the closing of the valve, and most of them are built so that anything that will pass through the valve opening will pass on through the hydrant.

Simple Test for Detecting Water in Hydrant.—One very important thing in regard to the elimination of freezing is making sure that the hydrant is not holding any water. Some do this by lowering a rubber tube into the hydrant and then blowing through the tube. A bubbling sound can be detected if there is any water in the hydrant. On the other hand, with a little experience, by taking off the hydrant cap with the mouth close to opening, speak loud, throwing the voice into the hydrant, and if the hydrant is dry the sound in the hydrant is more positive and clear than if it contains water. It is better to speak than to sing as a rule, but if you must sing, just a stanza or two will suffice, especially in the residential districts. However, on the main thoroughfares or among the factories, it is no serious breach of ethics to go the limit. But, seriously, in countries where water in a hydrant is really a great menace this would be a simple test, and a little experience will enable one to detect the presence of water.

In many cases you will find that hydrants have been in use for some years which were never securely blocked or fastened. Experience has shown that an ordinary earth fill is not sufficient. It might be all right if the hydrant is never used, and on the other hand, the cost and the effort required to place concrete blocks or rock behind the hydrant and at its base is very small indeed in comparison to the extra margin of safety which is insured.

In present - day fire equipment steamer outlets should be provided even where the ordinary pressure is ample for two streams. This will make possible the use of a pumper in case of serious fire. There is absolutely no argument against such a practice, and emergency is what should be provided for.

Painting Fire Hydrants.—Another feature that we have contemplated inaugurating in Fort Smith is a system of painting the fire hydrants so that the firemen approaching a hydrant to make a hose connection will know by the color of the hydrant whether the main from which it is fed is ample in supply or not. As I said before we have quite a few hydrants on 4-in. mains which places a big handicap on the fire department at such times as they are called upon to get their water supply from such a source.

Cost of Winter Sewer Construction

Mr. Geo. C. Stanley, City Engineer and Superintendent of Streets for the city of Burlington, Vt., gives the following report on day labor sewer construction in that city in a letter:

Unit Costs.—The unit costs as given below include trenching, backfilling, cost of sewer pipe, laying sewer pipe, manholes, together with manhole frames and covers, also engineering and supervision of all. These jobs were constructed during the winter with anywhere from one to five feet of frost to encounter in ditching. An Ingersoll-Rand portable compressor with jack hammers or paving breakers was used to penetrate the frost and break up the heavy clay. All of the jobs were in clay soil.

Unit Costs.

Job No.	Year	Lin. Ft.	Size In.	Cost Per Lin. Ft.
1	1927	646	10	$3.55
2	1927	179	24	7.53
3	1927	335	10	2.68
4	1926	558	12	3.44
5	1926	214	8	4.26
6	1926	410	12	4.88
7	1926	1636	8-10-12	2.78

Detailed Costs.

The gang includes one foreman and 10 or 12 men working by the hour from 7 a. m. to 5 p. m. The rate of wages for common labor is 40 ct. per hr., with a maximum of 52 ct. per hr. for mechanics or masons used in constructing manholes and catch basins. The rates for foremen are $36.00 to $40.00 per week, straight time.

Approximately 1,500 brick were used in each manhole, 10 bags of cement and one barrel of lime. Manhole frames and covers cost $25.00 per set. The cost of brick was $20.00 per thousand, cement $2.80 per barrel and lime $3.00 per barrel. Sewer tile was figured at 72 and 75 per cent off the list price.

Job No. 1—	
Material costs	$ 457.92
Labor costs	1,782.44
Engineering costs	51.32
Serving citations	1.62
Total	$2,293.30
Job No. 2—	
Labor	$ 983.79
Materials	361.66
Engineering	3.03
Total	$1,348.48
Job No. 3—	
Labor costs	$ 739.17
Materials	146.68
Engineering	12.37
Serving citations	2.56
Total	$ 900.78
Job No. 4—	
Labor costs	$1,517.17
Materials	266.06
Manhole costs	109.55
Engineering	25.12
Serving citations	5.05
Total	$1,922.95
Job No. 5—	
Labor costs	$ 704.38
Materials	91.98
Manhole costs	100.87
Engineering	12.21
Serving citations	1.95
Total	$ 911.39
Job No. 6—	
Labor costs	$1,587.11
Materials	279.58
Manhole costs	111.61
Engineering	18.46
Serving citations	3.70
Total	$2,000.46
Job No. 7—	
Labor costs	$3,278.48
Materials	782.04
Manholes	414.29
Engineering	49.37
Serving citations	26.43
Total	$4,550.59

In the labor costs is included the cost of the operation of a portable Ingersoll-Rand air compressor at the rate of $10.00 per day plus the operator.

Effect of Street Widening on Value of Abutting and Adjoining Property

Results of a Questionnaire to Municipal and Private Engineers

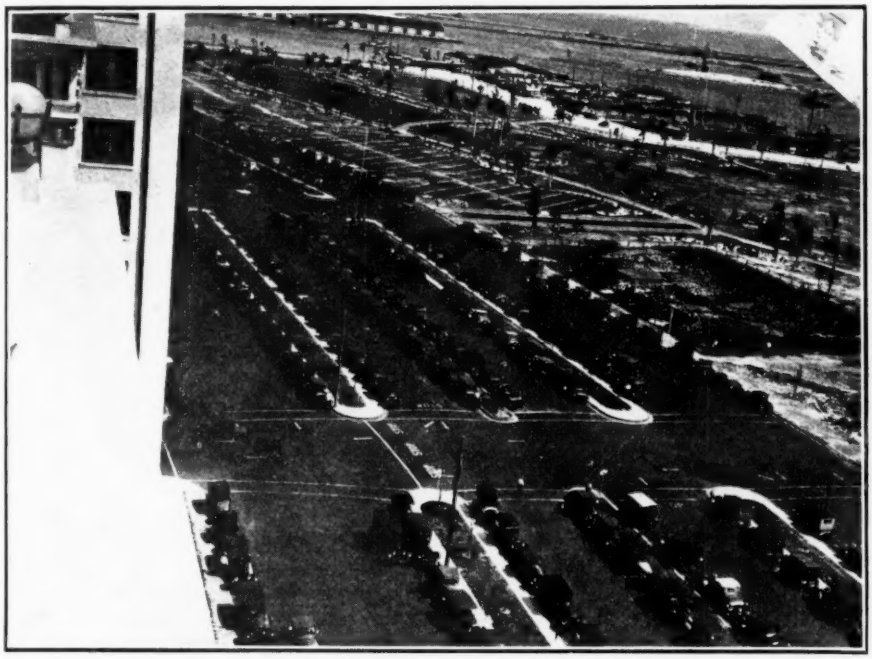


Fig. 1.—View of Biscayne Boulevard, Miami, Fla. This Boulevard Was Widened Several Years Ago to Provide Increased Parking Space. It Runs Along the Inner Bay with Large Hotels on One Side and a Park on the Other

HOW much does the widening of a street or the widening of city pavement affect the value of abutting and adjoining property? Well-authenticated information on this question grows more important as increasing numbers of cities resort to street-widening to meet a multiplying motor transportation.

To get such information, a survey among both municipal and private engineers was conducted. Returns showed that (1) in many cases records are not available over a sufficient period of years prior to the widening to give an accurate measure of its influence on property values; (2) that in other cases the necessary time has not elapsed since the widening to show what the full effects are; (3) that in many other instances factors, at present inseparable from the widening itself, have operated with it to produce a given result. These limitations, while preventing any graphical or tabular interpretation of the results as a whole, do not impair the worth of certain data that was obtainable, or present comparisons confined to a single city where differences in methods of levying taxes are presumably known to the man giving the figures.

Different Types of Development.—In a general way, the survey uncovered several distinctly different types of development that have been concurrent with or have followed closely major street-widenings. Some of these types are:

1. A stimulation of either business or residential growth on subdivided properties. This was noticeable where the widening made more or less of a main thoroughfare out of what had been simply a street. Stuyvesant Ave., Union County, New Jersey, is in part an illustration.
2. A change in the main use of the property from residential to business. Parts of Florence Ave., Los Angeles, are examples.
3. An increase in the desirability of business property, as such. Michigan Ave., Chicago, is an example.
4. An increase in the desirability of residence property as such. On this property apartment houses and apartment hotels replace to a large extent the single residence.
5. A radical change in the type of business conducted along a street. For an example, South Water Street, along the river in Chicago, long the province of wholesale produce-dealers, has by widening and double decking become Wacker Drive, lined by skyscrapers.

The survey also brought to light numerous examples of more specific information. Samples are presented here in three groups: (A) Comparisons between comparable widened and unwidened setreets where the depths of

Fig. 2.—View Taken May 7, 1927, Showing the Widening of 22nd St., Chicago

Fig. 3.—View of Old South Water St., Taken in 1925, Before the Street Was Widened

lots on the two streets compared do not differ by more than 10 ft.; (B) Similar comparisons where these depths differ by from 10 ft. to 50 ft.; (C) Opinions expressed where the engineer found his data insufficient or where he felt that any actual comparison that he might make would be misleading.

Street Fairly Comparable.—The following pairs of streets were judged fairly comparable before widening took place. The figures quoted are average tax values per front foot on lots differing no more than 10 ft. in depth.

New Haven, Conn.:

Property on Chapel Street, widened in 1920, was taxed at $400 per front foot in 1919 and $625 in 1927, an increase of 56 per cent. Property on George Street, an unwidened street given as comparable, was taxed $400 per front foot in 1919 and $425 in 1927, an increase of 6 per cent.

Milwaukee, Wis.:

Property on Oklahoma Avenue, widened from 66 ft. to 100 ft. on proceedings that began in 1915, was taxed $11.49 per front foot in 1919 and $42.05 in 1927, an increase of about 265 per cent. Manitoba Street, an unwidened street called comparable, showed an increase of 35 per cent in the same period.

St. Louis, Mo.:

Property on Seventh Street, widened from 60 ft. to 80 ft. in 1919, was taxed $85 per front foot in 1919 and $120 in 1927, an increase of about 41 per cent. Sixth Street, an unwidened comparable street, showed an increase of from $75 to $95 per front foot, or 27 per cent, in the same period.

Cleveland, O.:

Property on Superior Ave., widened from 50 ft. to 76 ft. in 1920, was taxed an average of $530 per front foot in 1920 and $1,279 in 1927, an increase of 141 per cent. Property on St. Clair Ave., unwidened street given as comparable, was taxed at $235 per front foot in 1920 and $328 in 1927, an increase of 40 per cent.

Streets Fairly Comparable Before Widening Took Place.—The following pairs of streets were judged fairly comparable before widening took place. The figures quoted are average tax values per front foot on lots differing from 10 ft. to 50 ft. in depth.

Chicago, Ill.:

Property on Wacker Drive (formerly South Water Street), widened and doubledecked in 1926, was assessed at $1,000 per front foot in 1919 and at $3,500 per front foot in 1927, an increase of 250 per cent. Market Street, an unwidened street also bordering the downtown district, was assessed at $1,300 per front foot in 1919 and at $1,500 in 1927, an increase of 15 per cent.

Charleston, W. Va.:

Property on Summers Street, widened from 45 ft. to 76 ft. (paving widened from 30 ft. to 46 ft.), was rated at $325 per front foot in 1919 and at $1,000 per front foot in 1927, an increase of about 207 per cent. Values on Capital Street, an unwidened street listed as fairly comparable, went from $1,500 to $2,000 per front foot in the same period or in increase of 33⅓ per cent.

Akron, O.:

Property on North Main Street, widened in 1922 from 50 ft. to 90 ft., was valued for tax purposes at $40 per front foot in 1919, at $26 in 1923 and at $60 in 1927, a total net **increase** of 50 per cent. Property on East Exchange Street, a comparable unwidened thoroughfare, was valued at $175 per front foot in 1919, at $120 in 1923 and at $124 in 1927, a total net **decrease** of about 30 per cent. The fall in tax values in 1923, according to the High-

Fig. 4.—View of New South Water St., Taken One Block Further South Than Fig. 3. There Has Been a 250 Per Cent Increase in Property Values in This Street Since 1920

way Engineer of Akron, was due to an arbitrary reduction by the county auditor, and the subsequent rise to reappraisal.

Baltimore:

In this case, depth of lots on the streets differed by more than 50 ft. after widening.

Property on Hillen Road, widened from 33 ft. to 120 ft. in 1923, was valued at $535 per front foot in 1919 and at $1,895 in 1927, an increase of about 254 per cent. Property on Falls Road, comparable unwidened street, went from $2,150 to $3,610 in the same eight years, the increase being about 68 per cent.

It will be noted in these samples, that in some cases the property values on widened streets exceed those on unwidened ones. In other cases the reverse is true, but in all cases the increase in tax value is greater on the widened than on the unwidened street.

Opinion by Various Officials.—The following are some of the opinions given by various officials. They are presented without any added comment.

District of Columbia:

"In the estimation of the Board of Assessors, all widening of streets and roadways has had a decided influence in increasing the values of abutting properties. The office could point to some cases where property values were more or less on a downward course and that such a tendency has been arrested by the widening and improving of roadways."—Wm. P. Richards, Assessor.

New Britain, Conn.:

"The only thoroughfare widened on which any data may be available is Chestnut Street widening just completed. No data as to increase or probable increase available. It is safe to assume the value of this street—centrally located—is due to increase. It is very probable that the widening will hurry this increase in value."—Thomas Linder, Chairman of Board of Assessors.

Flint, Mich.:

"We have had a number of cases where pavements were widened to accommodate business development along certain streets or portions of streets, on petition of the property owners. In these instances, the increased value of the property is apparent from the rapid development of the district."—Harry C. McClure, City Engineer.

Lakewood, O.:

"We have a small street-widening program in 1928, but no figures are available.

"On business streets unquestioned values are made because of increased accessibility. Our main thoroughfare, 66 ft. wide (paved 42 ft.), is too narrow to do business on. An 86-foot width with 56-foot paving would probably double the value of property in the business districts. Parking for shopping is the big problem in cities up to 100,000. (We now have a population of 65,000.)

"In business districts or projected business districts and along main traveled routes, street-widening for present and future traffic demands should show increased property values in excess of the cost of the improvement."—E. A. Fisher.

Winston-Salem, N. C.:

"We have several projects involving the widening of existing streets in the downtown districts which we propose to put through this year on petition of property owners. On one of these streets, the property owners have agreed to bear the entire cost of the project. There are four projects upon which property owners have agreed to pay 75 per cent on the cost of the work. In cases where the Board of Aldermen have instigated the widening of existing streets, the property owners pay only 50 per cent of the cost.

"As a general proposition, I would say without hesitancy that the widening of the street greatly increases the value of abutting and adjoining property."—Harry L. Shaner, Commissioner of Public Works.

Attention might also be called here to analysis of street widening in Los Angeles by John C. Shaw, City Engineer, Board of Public Works, Los Angeles, which appears in this issue of Municipal News.

It is only by the collection in the future of data as exact as is obtainable that the full influence of street-widening on property values can be obtained. In the light of the above and similar information, and in the absence of any contrary facts, it seems safe to generalize to the extent of saying that street widening or pavement widening not only makes traffic handling more efficient but that it decidedly profits the owners of property along and near the street improved; that furthermore, the increase in tax income following widening reinburses the city to a considerable extent for its share of the expesnse.

Highway Maintenance in Colorado.—On Feb. 1 the State Highway Department of Colorado took over all maintenance and reconstruction work on the federal aid or national highway system in Colorado. The same class of work on state roads, not included in the federal system, will be under the direct supervision of the county commissioners. The latter will have direct control over all expenditures on state roads for maintenance within their respective counties. On the federal aid system the state will have direct control of expenditures and will employ all maintenance patrols. At the same time the state will supervise the work done in ten counties having no federal aid roads and where the state will share the cost of maintenance on a "fifty-fifty" basis with the counties.

Power Equipment Cuts Maintenance Costs in Delaware County

The use of up to date equipment has made it possible for Sussex County, Delaware, to cut its maintenance costs in half and to do about four times as much, according to a report by Mr. Hill the County Engineer, presented at the recent convention of the American Road Builders Association. An extract from his report follows:

Sussex County, Delaware, has a large mileage of rural county highways. It has been necessary to turn to machinery and an organization to work throughout the year. Most of the machinery consists of one-man tractor graders, there being 22 of them. In addition there are one 10-ton tractor super mogul grader outfit, one 6-ton tractor Stockton 60 grader outfit, and 5-ton tractor super special grader outfit, and one 3-ton roller. With this outlay of machinery it has been possible to cut expenditures in half, and do about four times as much work. It was found that a good many of the one-man tractor grader outfits could do as much work for $7.50 as a team could for $32, the tractor being county owned and the team being hired from first one farm then another. Roads that were gone over with a scraper not over once a year are now gone over with scraper from 15 to 20 times a year. The big grader outfits have been used to widen and drain narrow roads at a fraction of the cost by the old method of team and labor. By the use of big graders grubbing is eliminated which makes a big saving. Instead of plowing all dirt roads are scarified thereby making another saving. A grader type of scarifier is used.

With the change over from team to machinery it was necessary to have a central shop to keep the machinery in repair. The county has a very up-to-date repair shop, well equipped, lighted and heated. All supplies, tools, and oils are bought at wholesale.

117,000 Mile of Highway on Snow Removal Program.—Reports received from the touring department of the American Automobile Association, show that more than 117,000 miles of highway are being cleared of snow and kept open to motor traffic this season. The roads making up the 117,109 miles to be cleared of snow are located in the thirty-six states which form the snow belt. The snow removal program of the states calls for the expenditure of more than $5,000,000 this winter. The average per mile cost will be about $45. The cost of clearing the highways of snow averaged $43.50 per mile last year and ranged from $6.40 per mile in Virginia, on the southern boundary of the snow belt to $136.62 per mile in Wyoming, in the northwest.

Street Maintenance in Small City

Paper Presented at 14th Annual Purdue Road School

By CLAUDE DRAPER
City Engineer, Lafayette, Ind.

THE city gravel street has long been a source of worry to the city official in charge. It has been a big argument against the political party in control by the opposition at election times. If the wonderful promises made by the opposite party to make the streets smooth and level could be fulfilled our troubles would be at an end. But when the political party does get into control and they spend dollar after dollar trying to get the gravel streets into shape and then to see them full of holes and washed out they are indeed disappointed, as is the general public.

The street commissioner of a city has vastly different problems to meet in maintaining city streets than the county road superintendent. The county roads are supplied with plenty of metal and if dragged will be kept in fine condition but in the city the street commissioner has crossings, manholes and curb grades to contend with and in our particular city of Lafayette, with its hillside streets, if the street commissioner tried to keep an abundance of gravel on the streets he would have an endless job.

Every year in Lafayette approximately 8 miles of streets are oiled. This oiling has saved many of our hillside streets from washing, but oiling is like feminine beauty, it is only skin deep. Also oiled streets will soon become full of pot holes.

Filling Pot Holes with Oiled Gravel.—Our street department during the past season have been very successful by filling these pot holes with oiled gravel.

Early this spring road oil was mixed in the gravel and the holes were filled. We found that this pushed with the first auto traffic and was very disappointing, but our street department did not give up. They mixed up several yards of the material in the city yards and let it lay for several days.

The holes were next squared up, that is, the edges were made vertical and the loose dust was cleaned out. The oiled gravel was then deposited in the hole and well tamped into place with a hand tamp. Traffic was allowed to hit the patches and the next day the patches were again gone over and worked into place. It was found that after this careful method of fixing the potholes was completed it was very hard to distinguish the patch from the rest of the street.

This method of oiled gravel street repair can only be made when the potholes are caught in time. If the street is allowed to disintegrate until the holes are too numerous the only solution then is to scarify, drag, roll and re-oil.

Costs Should Be Kept.—In summing up maintenance of gravel city streets I would say that a cost sheet should be kept of each street and when this cost becomes high on account of heavy traffic then the street should be paved with hard surface pavement or the gravel surface treated according to its location.

It is, however, not always easy to pave the streets that most need it on account of politics; which is indeed unfortunate.

When streets are paved it should be the engineer's fight to see that wide widths are constructed.

It is my opinion that a narrow street is sometimes more expensive than the wider streets, because on the narrow streets the traffic must follow certain tracks, whereas on wider streets the traffic may be distributed.

Resurfacing Old Pavements with Rock Asphalt.—The paved streets also develop bad spots and must be repaired. In Lafayette we had several old brick and asphalt streets that were in very bad condition. One street in particular was almost impassible. This street was constructed of 2-course brick and connects the heart of our city to a one-time famous old brewery, and if any of you remember the volume of business this brewery did, you will realize the enormous pound and grind of these steel tired and heavily loaded beer wagons on this none too hard brick pavement. Also the street had been literally gutted with trenches on account of this digup and that digup until it was almost gone.

In 1921 a patch of rock asphalt was placed upon this street about 20 ft. wide and about 100 ft. long. In three years this patch had stood the traffic so well that it was decided to improve the whole street with this same material.

So in 1924 a contract was awarded for the resurfacing of Fourth St. from Main St. to Salem St., a total of seven blocks.

In the first two blocks the thickness of rock asphalt was 1½ in. in the middle and 1 in. along the edge.

In the next few blocks the thickness of the rock asphalt was increased in the center until the last block where a total thickness of the rock asphalt was increased to 4 in.

This increase in thickness of the rock asphalt was made because the traffic had worn the old crown away and in some places the brick were three-fourths worn away. The rock asphalt was not laid the entire width of the old pavement; a strip of five feet along each side was not covered.

This saved the property owners considerable expense and also aided the crown.

It has been found that the edges of the rock asphalt have not ravelled and the street today is in fine condition.

There were several mistakes made in laying the rock asphalt on this job which have been eliminated in later jobs and are as follows.

The street crown should be built up with binder so that the rock asphalt can be laid on in a sheet of uniform thickness of not to exceed 1½ in.; also all holes or depressions on the street should be built up to grade at least thirty days before the rock asphalt is laid and given a good pounding by the traffic. On one street this year this patching was done so well and thoroughly that a committee of residents called and said that the resurfacing should not be made as their street was plenty satisfactory to them. Of course this was only part of the resurfacing.

In 1925 we laid two more jobs, Third and Fifth Sts., on old brick pavements.

In 1927 one block on South St., one block on Second St. and Sixth St. for about five blocks were resurfaced.

The Sixth St. and the Second St. resurfaces were made on old sheet asphalt surfaces.

The sheet asphalt was thoroughly cleaned by washing and scraping the deposits of oil that came from parked automobiles. The paint coat was then applied and the rock asphalt 1½ in. in thickness and 1 in. on the edge was then laid. Care should be taken in the resurfacing of asphalt streets to cut off all the bumps clear down to the base, as they are usually caused by shoving of the old binder. This should all be taken out and built up to grade with new binder. Care should also be taken to find all base failures before the resurface is made.

Costs.—The following is the cost per square yard of the work that has been done in Lafayette:

Street	Sq. Yd.	Cost per Sq. Yd.
4th	7,445.2	$1.40
3rd	1,698.6	1.44
5th	1,423.0	1.40
2nd	1,197.2	1.36
South	922.0	1.37
6th	6,495.5	1.38
Total	19,181.5	$1.39 1/6

We have used in Lafayette in the past two years about seven carloads of rock asphalt in street repair work.

Effect of Tire Chains on Pavements.—Rock asphalt has been used to advantage on our old asphalt streets that are now worn so thin that they soon break through with the use of steel chains on the auto tires during the snow period. It has been found by careful examination that these holes or breaks follow directly in the paths of the auto traffic and always show up just after the extended use of the chains on automobiles. Of course it is to be ad-

mitted that an auto without a chain on a snow laden street is a dangerous thing, but also our streets are to be protected and this hammer and grind of the non-skid chain is too much for them and if the use of these chains is allowed to continue it will cost the taxpayers thousands of dollars for the repair of our streets.

All our traffic on Main St. travels in the same tracks year in and year out.

There is no chance for it to deviate from these paths on account of a double car track and parked cars along the curbs. Every spring after the aforesaid tearing up by the auto chains, these paths or tracks were filled with numerous holes. The repair gang then have a job on their hands filling the cavities.

Repairs Along Street Railway Tracks.—This summer we tried to get the "jump" on the holes and in cooperation with the local street railway company we not only filled the holes but resurfaced between the tracks and about two or three feet on either side thereof. This resurface varies in thickness from ½ to 1½ in.

The space between the tracks and about 1 ft. outside the rail was taken care of by the street railway company and the balance by the city. During the resurfacing one side of a block was blocked at a time.

As soon as a section was rolled it was opened to traffic. This resurface has apparently adhered to the old pavement, which was of all descriptions, and to date the resurfacing is in excellent condition. About three carloads of material were required for the job and the expense was about equal to the city and street railway company. No account of the cost per square yard was taken due to the irregularity of the resurfacing. It is hoped that we now have a sufficient thickness of asphalt that will stand the pound of auto chains and that this spring no holes will appear.

The Importance of Competent Inspection.—In closing I might say that the best repairing we can do is at the time of construction, by having competent inspectors on the job.

Inspectors should not be given jobs to pay political debts and the engineer in charge should not tolerate such a practice.

About seven years ago an alley pavement was put in under one of these kind of inspectors. He was a good old party worker, but about all he knew about concrete construction was that it was to be a certain thickness. He let the contractor know that he was there to see that thickness was obtained. Each time the mixer moved ahead he had the workmen stretch a string from form-board to form-board and he would do the measuring, but on account of his inability to see good he failed to notice that the workmen held their fingers under the string. Whatever else that happened on this job is not known, but the alley has recently been repaired by the contractor after a litigation of two years' duration.

Aerial Arterial Highway Plan for St. Paul, Minn.

An interesting plan for an aerial arterial highway to be built over the railroad tracks and yards in the downtown district of St. Paul, Minn., has been presented by John F. Druar of Druar & Milinowski, Consulting Municipal Engineers, St. Paul. The purpose of the plan is to provide for the parking of some 4,000 cars and to carry a double street car track so that the street car congestion of the loop district may be supplanted by one way service which will result in greatly speeding up the street car traffic.

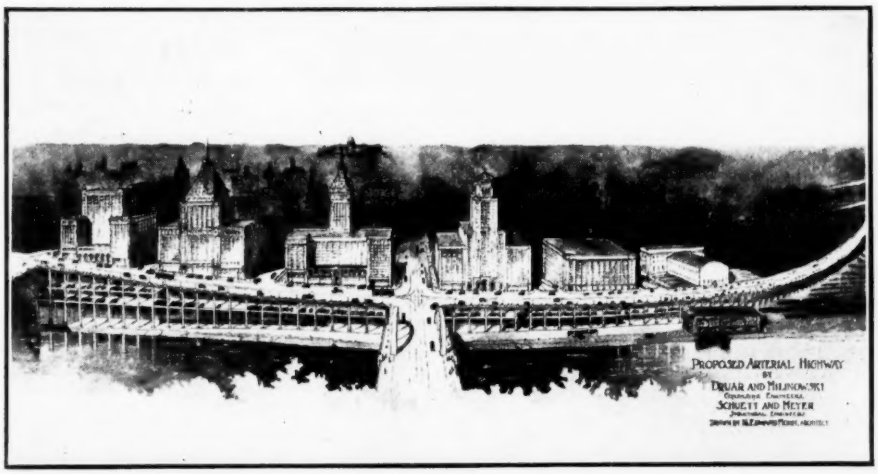
This plan will cost about $6,000,000 and the entire interest on the investment will be borne by auto parking rentals and other concessions. It will afford St. Paul an aerial drive from 70 ft. to 125 ft. above the railroad tracks and nearly two miles long. The south side of the drive will be open and afford a splendid view of the Mississippi River and the opposite bluffs. The north side will abut private property of very little value at the present time but which will become extremely valuable in the future. The problem involves the air rights of the railroad but on the other hand will provide a covered way for the railroad tracks really saving the railroad company a considerable amount of money in winter operation.

The highway proper will be 100 ft. wide 12 ft. walkways being reached by subway so that the pedestrians will not have to cross through traffic. A double street car track will divide the outer or through traffic from the inner lane of local traffic and will be arranged so as to divert the double system of street cars from the narrow congested streets of the loop district. This will speed up both the street car and auto traffic to a great degree.

The outer drive will be a continuous arterial highway from Dayton's Bluff on the east to the High Bridge on the west connecting the federal and state highways from the north and east to the south and west. This highway will be available for entrance to and exit from at the principal street intersection but still will have no cross traffic to contend with. Ramps will connect the Union Depot and excursion docks with the highway and eleven street intersections will be available on which one can enter the local traffic lanes.

The principal feature of this highway will be the great space provided for covered auto parking. This will be accomplished by separate decks below the main highway and approached by ramps from each street intersection. There is space for the parking of about 4,000 cars and from time to time as necessary this can be enlarged at small cost. The parking space can be fully enclosed if considered necessary. The best part of the plan is that the parking of 2,800 cars daily at a reasonable parking charge will pay the interest on the investment and other concessions would go toward a sinking fund to pay off the principal. The parking space is all closely available to the downtown or loop district and will do away with any loop parking. Each street intersection will have its own ramps and the car owner can park his car at the nearest point to his place of business which will not be more than four blocks away. When he enters his car, he may take any one of several lanes of traffic that will lead him without delay or undue congestion to his residential section.

This plan will give St. Paul a splendid scenic highway and when the north side of the highway is built up, it will present a second Michigan Boulevard and Wacker Drive. There will be several plazas for bus stations and shelters for street car patrons. Provision is even made for the future in an upper deck 150 ft. wide by a mile or more in length for a landing field for airplanes with provision for hangars and other accommodations for air travelers.



Artist's Drawing of Proposed Aerial Arterial Highway for St. Paul

Street Signs at Albany, N. Y.

New System Described in Paper Before International System of Street Sanitation Officials

By LESTER W. HERZOG
Commissioner of Public Works, Albany, N. Y.

A COMMUNITY, in signing its streets, should give thought to ornamentation and durability rather than to the first cost. For many years the city of Albany was inadequately signed. At one time signs were placed on the corner buildings but in many cases the buildings were torn down and repainted and the signs never replaced. When new streets were built, no signs were erected. This was particularly confusing as it is mainly in the newer sections of a city where signs are mostly needed.

We can all recall in our several cities certain sections which are as familiar to us as our own homes. We know the names of all the streets in these particular sections and just where they are located yet it is difficult for us to go directly to any particular street unless it is properly signed.

In 1926 it was determined to completely sign the city of Albany. A careful investigation was made of all types of signs and at all kinds of prices. After a thorough investigation, we selected an alloy of aluminum type of sign.

The New Sign.—This consists of a cast iron post covered with aluminum alloy and the sign itself is an ornamental one with an aluminum alloy border with letters of the same material. Each plate on the cross type of sign measures 4 in. by 20 in. These signs are placed on posts 11 ft. in length and projecting 8 ft. from the surface of the ground, erected on diagonal corners, only two poles being placed at each intersection. Each pole has upon it a sign carrying the main street and at right angles to it, a sign with the name of the cross street. These are set in a concrete base and we found by experience that the poles after being erected were subject to being pulled out before concrete was entirely set and in some cases after the concrete had set. To overcome this, we drilled holes through the base of the post and placed two bolts at right angles to each other. This, we found held the sign securely in place.

The Boulevard Sign.—On the streets where boulevard lights were erected, we placed what is known as a boulevard or wing type of sign which measures 5 in. by 24 in. and has the intersecting street placed in smaller letters on an opposite plate measuring 3 in. by 18 in. over the main street plate, all embodied in the one sign. These are placed on the electric light poles at right angles to each other.

On our main street "State St." which runs to the Capitol, we placed a particularly ornamental type of sign having the letters in a vertical position. This sign comes in four sections and bolts on the pole and measures 5 in. by 24 in. This sign was placed on all four corners and the name of the street one is on, is seen from all directions. This sign also has the seal of the city on the top.

Protection of the Signs.—After the installation of these signs, we found considerable trouble with boys climbing the poles and hanging from the signs and in many instances breaking them. For the first two or three months, we had considerable of this breakage but after the novelty wore off and after a few arrests, this trouble was overcome to a great extent. In addition to this, the manufacturer improved the cross type of sign by placing a series of ornamental teeth across the top which made it impossible for anyone to deliberately break the sign by hanging from it.

The Boulevard Type of Sign Has the Intersecting Street in Smaller Letters

The appropriation for these signs was $50,000, which was voted by the common council and this covered the entire city, the number of signs purchased being approximately 1,800. Later it was deemed advisable to appropriate an additional $15,000 for new signs, replacements and repairs. At the present time, we have a crew with a small truck whose sole duty is to take care of these signs and see that they are kept in perfect condition.

We often have signs which are knocked down by motor vehicles and the cost of these are charged to the owner of the car which did the damage.

In the repaving of streets, the signs are of course removed and replaced after the street is completed. It has not been our custom, however, to place signs on streets which are not paved as we believe where there is no curbing, there would be considerable damage done to the signs.

It is, of course, impossible to estimate the financial value of these signs. We have, however, been told by many merchants that an enormous amount of time was saved in deliveries after their erection. I do not think it is far fetched to say that the value of the time saved in deliveries has more than paid for the signs during the period they have been erected.

Street Numbering.—This question of "signs" undoubtedly brings to mind another subject which is becoming of increasing importance and that is the proper designation of streets by numbers and the proper numbering of streets. Many cities are taking the initiative in this matter and I think the time is not far off when the business value of having streets designated by numbers will overcome the sentimental side of naming streets after noted persons or historical events or with family names of the particular real estate operator who opens up a certain section.

With the proper designating of streets by numbers will follow the scientific numbering of houses. I understand some cities have already taken this forward step and the numbers on each block corresponds to the number of the crossing avenue so that knowing the house number one can immediately determine that it is between two certain avenues.

Culvert End Walls to be Removed in Wisconsin

As a result of numerous accidents the Wisconsin Highway Commission has directed the removal of culvert end walls on the state trunk highway system within the next two years. An extract from the letter to the division engineers follows:

"Two or three of the divisions have done quite a little work in removing culvert end walls. We refer to those end walls which were built some few years ago and which now constitute one of the most serious hazards which we have along our highways. We would suggest that you give this matter considerable thought and if possible arrange a program whereby we can eliminate practically all of these end walls within the next two or three years.

"In a great many cases you will find that it is not necessary to extend the culvert. All you have to do is use some care in removing the old end walls. In other cases you may find it necessary to extend the culvert for 3 or more feet on either end. This can be done very easily by inserting a short section of corrugated pipe made up special for this purpose in such a manner as to fit the square opening in the culvert.

"If you have any particularly short culverts on your main traveled roads we would like to suggest that you give this matter your serious consideration and arrange for the removal of the head walls early next season. We would also like to pass on to you the suggestion made by one of our county highway commissioners to the effect that whenever you start to remove the culvert head walls on any particular highway that you go clear through on the highway from one point to the next at least."

New Filtration Plant at Waukegan, Ill., Designed on Duplex Plan

Notes on Design and Special Equipment That Shows Interesting Modern Features

THE increasing pollution of the waters of the Great Lakes, source of water supply for many communities, is bringing about a water purification program in many a city. An interesting filtration plant and pumping station is now under construction for the City of Waukegan, Ill., that might be said to show modern features both in general design and in the equipment to be used.

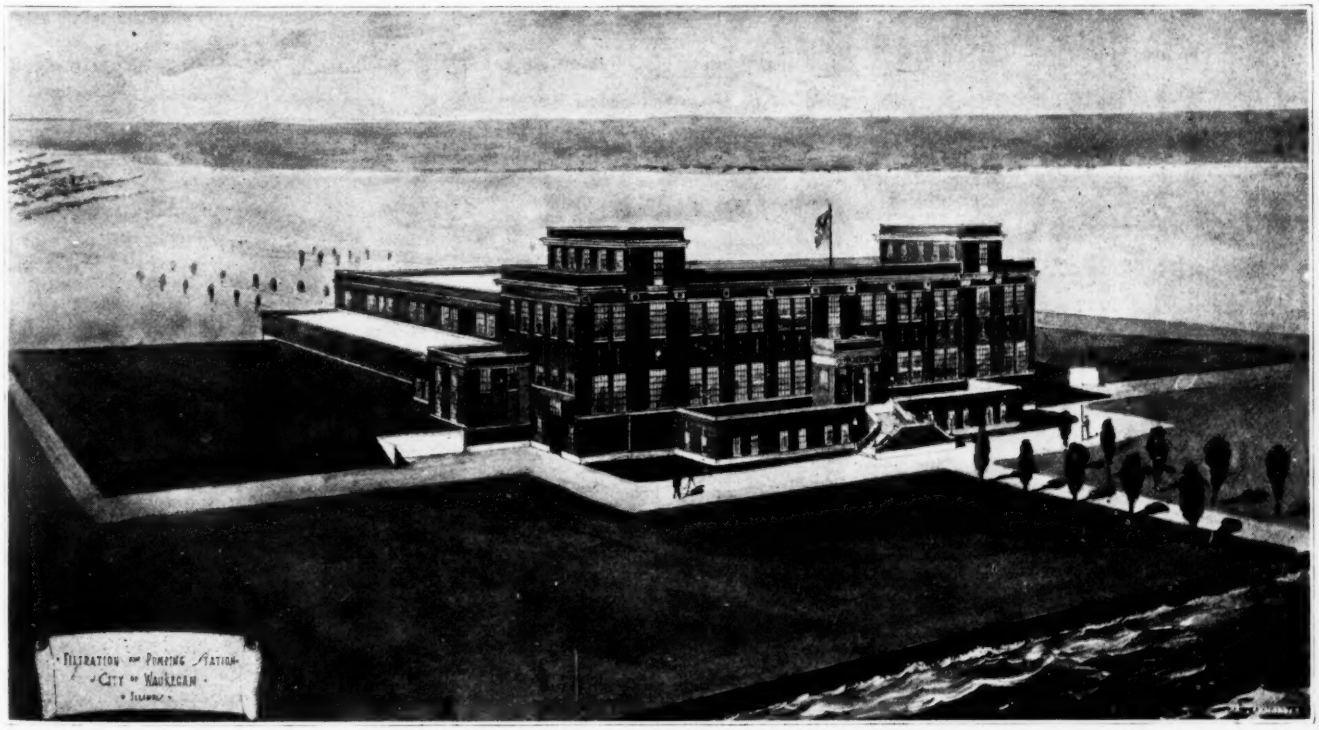
The plant is situated on a peninsula at the north entrance of the harbor. Its front faces south, plainly visible from both the lake and the shore. The plant is designed to take water from an existing 24 in. intake extending in an easterly direction into the lake for a distance of approximately 4,000 ft. from the shore, and taking water from a depth of about 27 ft. This water is of a better quality that could be secured in the shoals nearer the shore, but requires treatment before use, since lately the B. coli count has been reported as running quite high. Since deep water has been determined as lying to the south-east, indicating the desirability of a future intake in that direction, the connection with the existing intake was made by means of a shaft to the south of the south Government Pier, provided with a second opening for use when a future intake could be provided. This shaft opens to a new 5 ft. concrete lined tunnel under the harbor, leading the water to a second shaft in the plant. These shafts have an inside diameter of 8 ft. at the top and 6 ft. at the bottom, and provide for an emergency intake that would permit taking water from the harbor in case of need.

A Duplicate Plant.—The plant is designed on the duplex plan, in such a way that either half may be operated as a unit. Cross connections are provided so that any unit of one half the plant may be used in connection with the operation of the units of the opposing half. These duplicate plants are symetrically arranged with the inner intake shaft as an axis.

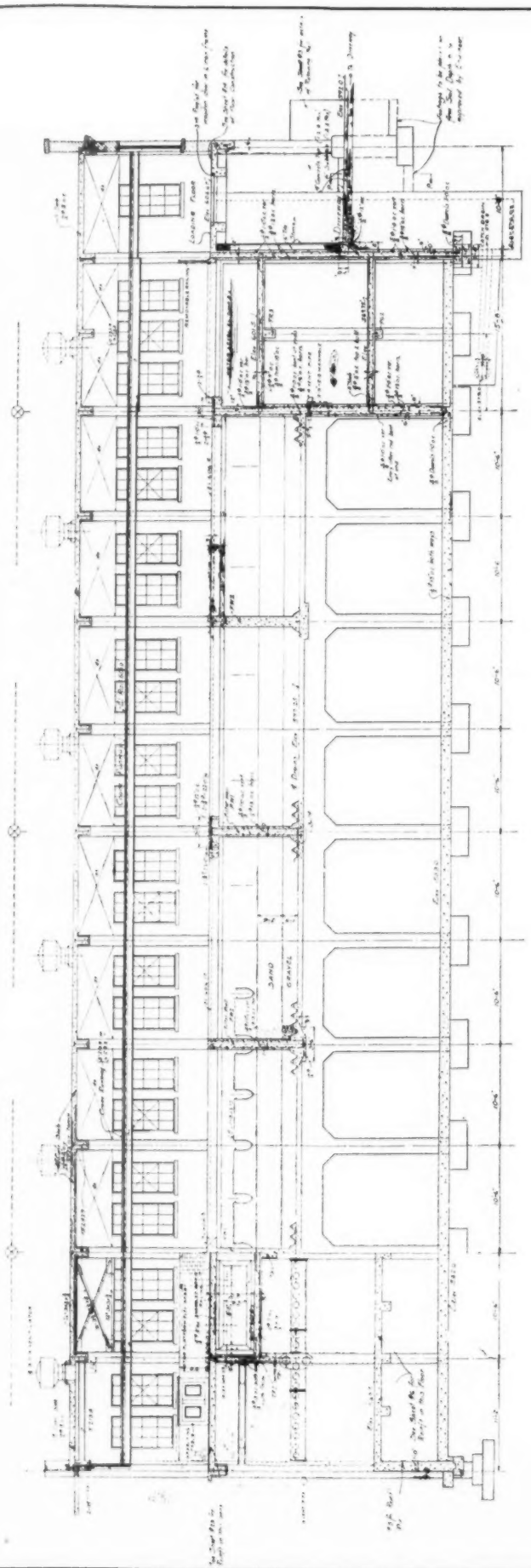
Pumping Equipment.—The raw water is pumped by four 5 M. G. D. Allis-Chalmers vertical direct-connected electric motor driven centrifugal pumps, two on each side of the centerline, through two parallel Venturi meters, one for each side, into cast iron grit chambers, from which the water flows into the Primary Aerator channels.

New Type Aerators.—The designer of the plant, who favors aeration as an effective method of water purification, has designed a new type of aerator for installation in this plant. These aerators are said to give the most effective action at the least cost of space or operating equipment. They are based upon the principle of the trompe or hydraulic air blast, one of the early types of compressed air devices. The principle is very simple, consisting of a pipe into the upper end of which water flows, and below which entrance holes admit air sucked in by the water passing down the pipe into a tank. The liberated air passed out of the top of the tank, while the water flowed out the bottom at a predetermined level. This principle is now used in various types of injectors, inspirators, and in the Taylor air compressor.

The aerators for the Waukegan plant were designed on the same principle. In this case the air, at about atmospheric pressure, is sucked in by water flowing by hundreds of tube ends, and the mixture discharged into mixing chambers at 16 to 20 ft. below the water surface. The air being under a pressure about equal to that of the head of water in the chamber, and its specific gravity being about one eight hundredth that of water, it is rapidly forced to the surface. This causes three important actions to take place. It agitates and mixes the water thoroughly. Too, it mechanically carries off odors in the water when it is liberated from the surface. Then, because



General View of Plant as It Will Appear When Completed



Section Through Filters Showing General Arrangement

of the intimate mixture with the water thus secured, it enables a maximum amount of oxidation to take place in the available time of contact. The compressing of the air is thus done without mechanical contrivances of any kind except for the pipe in the aeration chamber that conducts the water into the mixing chambers. The water level in the mixing chamber is from 3 to 4 ft. below that in the aerator.

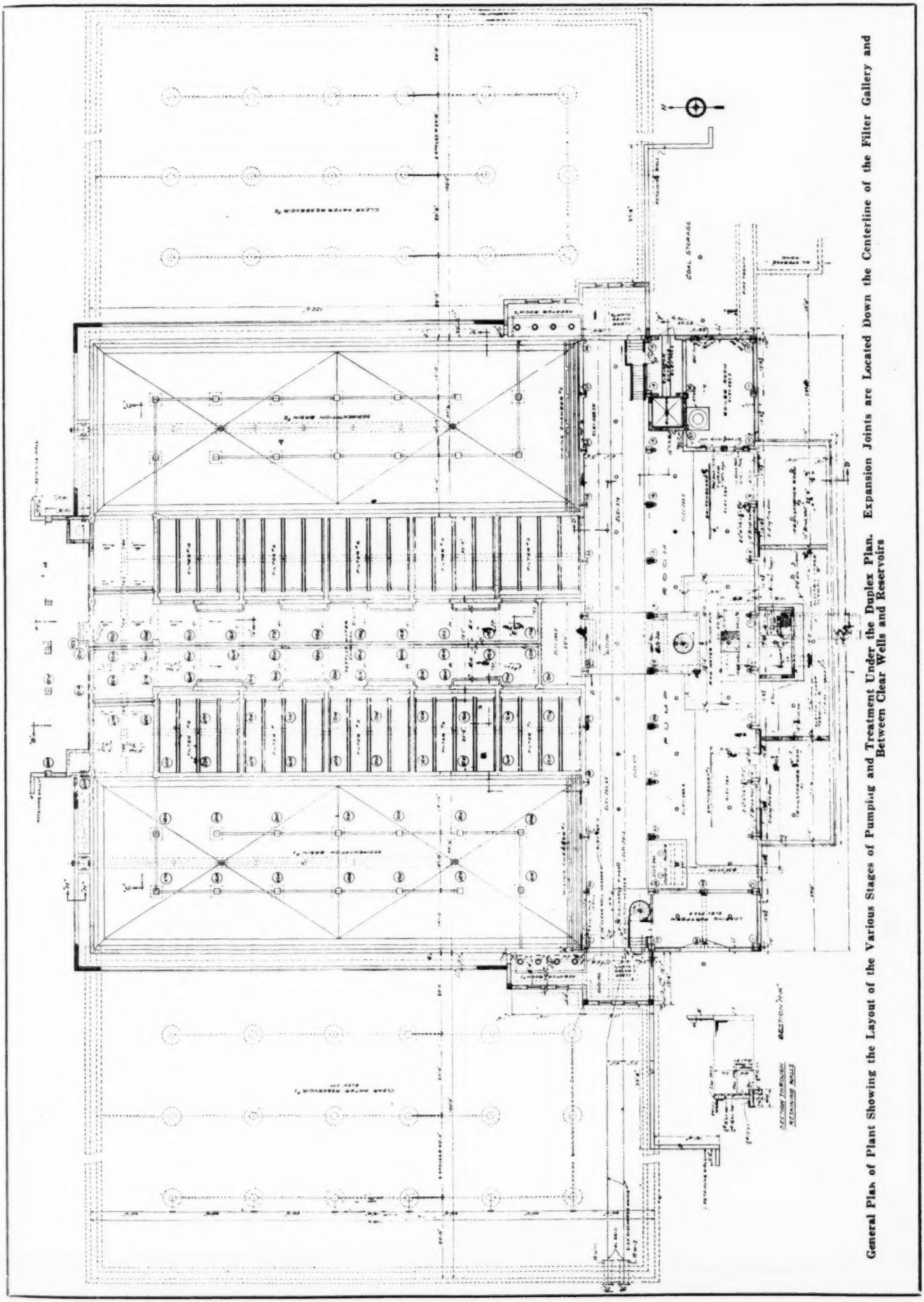
Chemicals may be added to the water in the aerator, thus obtaining a perfect mixing without further mixing equipment. Thus chlorine or coagulants may be thus added if so desired.

This system requires but little space, and does not require a large area of water that would be open to the direct rays of the sun in summer and to freezing in winter if not covered. The air used may be easily pre-washed and also may be combined with chlorine or other gas if desired. The mixers are 5 ft. by 40 ft. by 20 ft. deep.

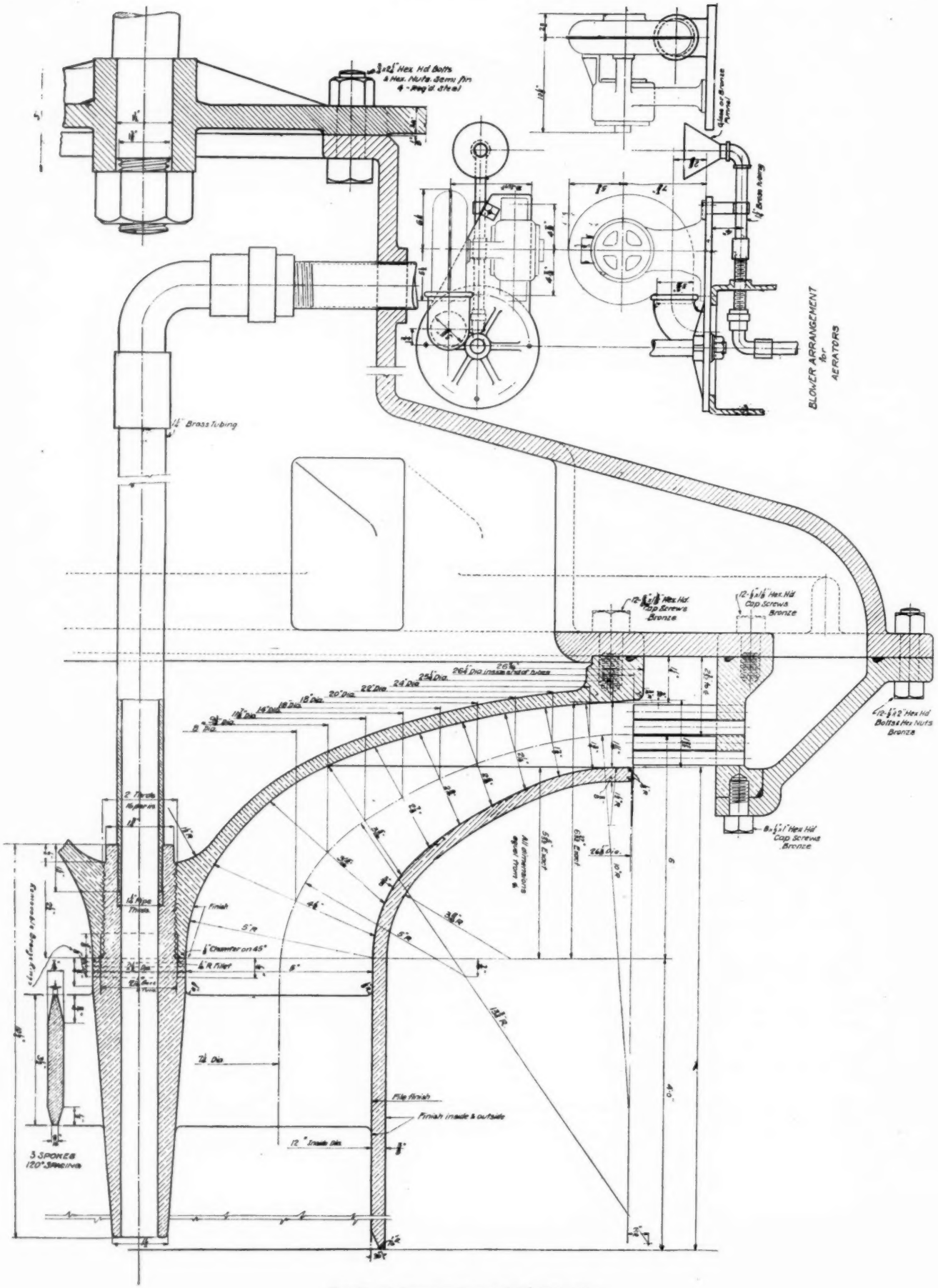
Sedimentation Basins.—The mixture of air and water at the foot of the aerators pass through specially designed baffled mixers, at the top of which the air is liberated and the water passes down to the bottoms of the sedimentation basins. Here coagulation takes place and excess entrained air is liberated. The retention period in this stage of the process is 3½ hours. Next the water passes to the filter beds through settled water channels and 96 in. wide by 28 in. high sluice gates. Low velocity in the settled water channels is secured by making these channels shallow and 8 ft. in width.

Filters.—The plant contains ten filter beds in all, five on each side of the central filter gallery, and each with a rated capacity of 1 M. G. D., or the equivalent of 1 cu. ft. of water per minute for each 4 sq. ft. of area. Each filter is equipped with a specially designed underdrain pipe system, originated by the designing engineer, consisting of a cast iron header in the front wall of the filters, from which project 20 tubes across the filter bed in the bottoms of the triangular troughs comprising the filter bottoms. These tubes have ⅛ in. holes drilled in them, spaced to allow for differences of velocities in the various sections of each tube so as to give constant velocities throughout the entire system.

The layout of these holes is based upon the velocity of water through an orifice in a thin plate. In order that corrosion of the tubes may not take place in time and increase the size of these openings or close them, the tubes are made of bronze. This is considered of particular importance, since a later adoption of the split system of chlorination might lead to excessive corrosion of this equipment. This and other equipment such as filter troughs in the plant exposed to corrosion by chemicals is protected by a special



General Plan of Plant Showing the Layout of the Various Stages of Pumping and Treatment Under the Duplex Plan. Expansion Joints are Located Down the Centerline of the Filter Gallery and Between Clear Wells and Reservoirs



Details of Aerators Invented by Col. Allen

sprayed protective coating. Each filter is equipped with a control table equipped with substantial push bottons for the operation of the wash water pumps. Provision is also made for the crossover of water from the coagulating basins on one side of the plant to any filter bed on the opposite side in case it is desired to operate in this manner.

Each filter is also equipped with a rate controller, water sampling device, and rate and loss of head gauges, and adjustable bronze wiers. The pipe gallery contains two complete sets of wash water and drain piping, making the plant truly a duplex system. Equipment in the pipe gallery is all exposed but under the operating floor, so as to be readily accessible without detracting from the appearance of the station. The utmost neatness and simplicity is observed in the pipe layouts in spite of the completeness of the system required for duplex operation.

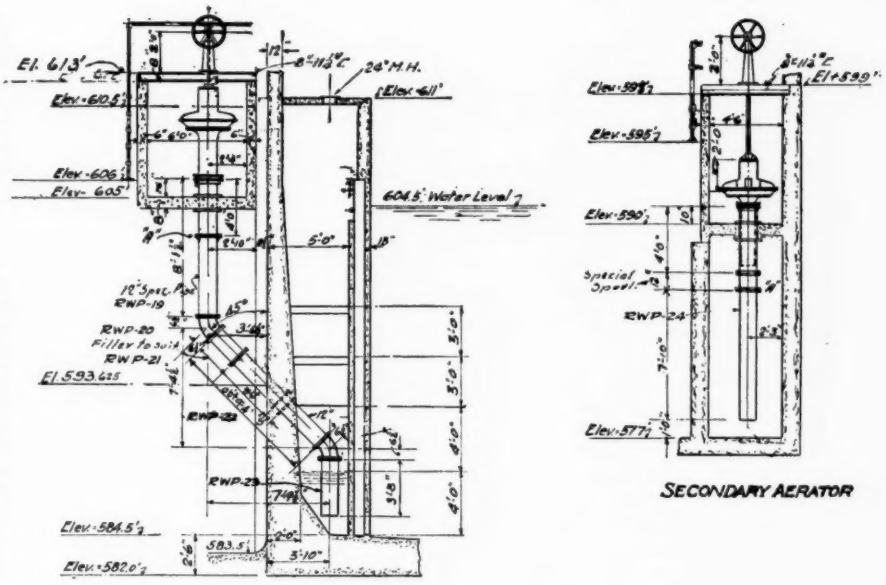
Clear Wells.—The clear wells are situated beneath the filters and the pipe gallery floor. They are connected to a clear well main located between the two filtered water storage reservoirs, one on the outside of each sedimentation basin. One or both of these clear wells may be discharged into both or either of the storage reservoirs. Special floats and hydrualic regulators maintain constant head in sedimentation basins and filters.

Automatic devices decrease the rate from a certain predetermined level and cut off the flow from filter beds when a predetermined maximum elevation has been reached in the reservoirs. At each end of the clear well main a small basin conncets with the secondary aerator channel.

Chlorination.—Two chlorine booths one on each end of the main pipe gallery, each equipped with two chlorine machines, afford a means of chlorinating the water in any way desired by means of the dry gas feed process. These machines are situated above the tanks at each end of the clear well main, the piping leading directly down and the chlorine being discharged into the outlets of the clear well main. The chlorinators will use the standard 100 lb. containers.

Provision has been made for split chlorination, should this be found in actual operation to be necessary.

The secondary Aerators are similar in construction to the Primary Aerators and as the chlorine is applied to the water before reaching these aerators, the chlorine is perfectly mixed when discharged through the aerators into the storage reservoirs. From these points on the water travels between concrete walls to prevent short circuiting or stagnation, a distance 1,000 ft, before entering the suction main between the two filtered water storage reservoirs. This gives a retention period of 12 hours, or ample time for the release of excess entrained air and residual chlorine.



PRIMARY AERATOR

SECONDARY AERATOR

Drawing of Primary and Secondary Aerators

Any other gas or chemical that may be found desirable to neutralize odors that have not been eliminated by the grit chambers, primary aerators and sedimentation basins, may be introduced through the aerators. The plant has been designed for the use of alum for coagulation, but can be readily equipped for other forms of treatment if desired.

Handling the Chemicals.—Among the special features are the loading platforms, at each end of main pump room, one for receiving the chemicals and supplies, the other to enable a truck to back in and load a transformer on end. A comparatively new system of proportionate feeding will be used.

An electric hoist on a hand operated traveling crane, over the pump room, provides for repairs in this department.

A traveling crane over each bank of filters with electric hoist is installed for handling gravel and sand and guarding against all damage to the appearance of the filter gallery when such material is handled by wheel barrow and bucket over the filter gallery walls or railings. An automatically controlled safety elevator will be provided to run from the pump room floor to the chemical floor. The floor of the cage will be provided with a turn table for receiving chemical cars and facilitating work of loading and unloading.

To ensure against damage to elevator sides, doorways and concrete pillars and tanks on each side of chemical floor, cast iron industrial tracks with turn tables are provided.

Power.—Power will be supplied by the Public Service Company of Northern Illinois, which company has entered into an arrangement with the City of Waukegan to permit tapping to each of two main trunk lines connecting their two large power plants situated in Waukegan. The cables will lead through two 6 in. wrought iron pipes underneath the Waukegan Harbor and into the plant at a voltage of 12,000. Both the high tension and low tension switch gears will be of the Reyrolle type. Two banks of transformers are provided, the switch gears being provided with a selective switch so that in case of anything happening to one of the main power lines, the other bank of transformers is immediately cut in. This gear was decided upon because of safety in operation and reliability, it being almost impossible for the careless short circuiting of main station switchboard wiring. A hydraulic gauge board is provided for control of hydraulically operated gate valves from the main gallery. On main gallery are also situated the recording devices of both raw water and discharge Venturi meters. A gauge board containing the various level gauges is provided on main gallery at the end of filter gallery for convenient observation. This gauge board is arranged with the odd numbers on the right, and the even numbers on the left, arranged as all the units controlled. A plate on the board, laid out in the form of a flow chart, serves as a key to the operation of this board. All hydraulic valves are worked from a central valve board. Records provide for six records on one chart without the need for integration.

Laboratory.—A well equipped office for the plant superintendent and a roomy laboratory well equipped with materials and required scientific ap-

paratus will be situated on the chemical floor.

A well equipped machine shop suitable for making ordinary repairs and necessary locker rooms, lavatories, store rooms, fuel and oil storage tanks, coal storage room and station heating plant with complete equipment capable of using either coal or oil for fuel, are provided in this section of the structure.

The Building.—The architecture of the building will be of the plain, substantial type. The brick work will be seal brown in color with raked joints, and the trimmings will be terra cotta of light gray stone color. To hold the sand and for convenience in maintaining cleanliness around the plant there will be provided suitable concrete roadways and walks. The top of the filtered water storage reservoirs will be earth covered and sodded. The grounds in the vicinity of the plant will be filled to smooth surfaces so as to give a park effect and enhance the beauty of the entrance to Waukegan Harbor.

Capacity.—The plant when completed will have a daily pumping capacity of 20 M. G. D. and a filtered water storage reservoir capacity of about 4,300,000 gal. The maximum rate of filtration will be about 15 M. G. D. The plant is now well along toward completion.

Those Responsible.—The plant was designed for the City of Waukegan by Col. Henry A. Allen, designing and consulting engineer, and the work is proceeding under his direction. The pumps, and all electric equipment are furnished by the Allis-Chalmers Mfg. Co., the filter structures, steel work, tunnels, etc., are being constructed by Cope and Fischer, contractors, Decatur, Ill., subaqueous pumping work is being done by George A. Green, of Green Bay, Wis., electric wiring is by the Krigbaum Electric Co., of Decatur, Ill., heating and station piping is being done by Ashton and Russel, Chicago, and filtration appliances, control tables, filter sand and gravel, and chlorination equipment is supplied by D. W. Bacharach and Co., Kansas City, Mo.

How Small City Financed $500,000 Water Works and Sewers

Use of Front-Foot Benefit Charges Described in Journal New England Water Works Association

By F. H. DRYDEN

Chief Engineer, Salisbury Water and Sewer Commission, Salisbury, Md.

SALISBURY, with a population of 10,000, an assessable basis of less than 11 million dollars, burdened with an inadequate, privately owned water-work system, serving only 800 homes, and a small combined sewer system covering less than one-third of the public streets, presented a bill to the Legislature in 1924, requesting authority to issue bonds for $550,000 to cover the cost of constructing a water-supply and sewer system in the city of Salisbury. This bill was pased during the same session, subject to the ratification of the voters. Prior to the election on this issue, a campaign was conducted to acquaint the voters with the advantages to be gained, and an attempt was made to show the ultimate cost to the taxpayers. This campaign resulted in the bond issue being carried by an eight to one majority.

The enabling act for this work provided alternate methods of financing: (1) Front-foot benefit charges, applicable to properties abutting on the improvement, and a property or general tax to cover the proportionate cost of the systems beneficial to all taxable property. (2) The straight general tax plan. The first of these two methods was accepted for our use.

The water-works and sewer systems were designed for an ultimate population of thirty to forty thousand, and the water supply, pumping station and equipment, and the trunk sewers were constructed on this basis, representing an expenditure of approximately $350,000, or two-thirds of the entire bond issue. The balance of the funds was used in building lateral lines to furnish fire protection to all sections of the city, and water and sewer service to 50 per cent of the population. These conditions, together with the fact that the privately owned water company was acquired, and a number of existing sewers, constructed partly by individuals and dedicated to the city, were incorporated in the general systems, presented numerous difficulties in the division of charges between the general tax and the front-foot assessment.

The bonds covering this work were issued as 30 year serial bonds, so maturing that the carrying charges approximated $35,000 annually. This annual charge was met during the first two years of the construction program by the interest received from local banks on deposits, and an addition of 10 cents per $100 on the general tax.

Front-Foot Assessment Plan.—To carry into effect the front-foot assessment, it was necessary that all property frontages be measured, that the properties be classified as to their uses and that complete records be installed to care for property transfers, collections, etc.; which involved an expenditure of several thousand dollars. After numerous adjustments of figures, a schedule was worked out proportioning 20 ct. per $100 to the property or general tax and a front-foot assessment for residential properties having both water and sewer improvements of 20 ct. per front-foot and 33 ct. for business or commercial properties, each having a graduated scale after the first 150 ft. A nominal charge for agricultural properties was included. These taxes and assessments were to continue during the life of the bonds. It was estimated that these charges would produce a revenue of $38,000 annually, which amount was required to meet the interest and retirement on the bonds and the maintenance of a collecting office. Notices of assessments were mailed during August, 1926, as required by the enabling act, and a time set for a hearing. At this hearing hundreds of property owners appeared, protesting on the matter of assessment for water mains and sewers constructed previous to this bond issue, although they had been acquired by the city. In numerous cases it developed that the property owner had paid a portion of the original construction cost. Others claimed they did not want the improvements and objected to the assessment. This hearing disclosed the fact that the front-foot assessment method of financing met with the general disapproval of the taxpayers, while comparatively no objections were made to including the entire cost in the general tax. The method of financing, therefore, was immediately changed and a total of 34 ct. per $100 was added to the general tax in October, 1926. This tax is collected with the other city taxes by the city treasurer without additional cost, thereby effecting an annual saving of approximately $3,000 in office expense.

Benefits Received by Tax Payers.—It was the original opinion of those handling the financing of this project, that such an increase in the general tax would meet with considerable objections, but the fact that it was accepted generally, is partly explained by the benefits that were directly received by the taxpayers. These are as follows:

1. A33—40 per cent reduction in water rates, reducing flat-rate charges for the average home from $25 to $15 per year, and reducing meter rates from 30 ct. to 20 ct. per 1,000 gal.

2. The elimination of the $5 charge for tapping water mains and the $25 charge for tapping sewer mains.

3. Construction of water and sewer service pipe to the property of the consumers without charge.

4. The maintenance of water and sewer service connections in the public streets.

5. The elimination of the annual charge of $20 for each fire hydrant in service, also eliminating the charge to property owners for water used in fire service.

6. Reductions in insurance rates.

Annual Saving from Improvements.—The records for the year ending June 30, 1927, show that the above projects have effected an annual saving of approximately $65,000 to the citizens and taxpayers of Salisbury; $40,000 of this amount representing the saving in fire-insurance premiums, brought about by a reduction of 20 per cent in insurance

rates for industrial and commercial properties.

The major portion of the construction of the original project was completed in the latter part of 1926. An additional appropriation of $200,000 was authorized by the Legislature in 1927, for the extension of the water and sewer systems. This issue was placed before the voters in May, 1927, and was passed with only 30 dissenting voters; which fact speaks for itself as to the general approval of this entire project.

The new water plant was placed in operation on July 1, 1926, at which time the old privately owned plant was abandoned. Upon assuming operation of the water works, the city placed into effect the reduction in water rates and elimination of certain charges, as enumerated above, and the elimination of the tapping service charges and hydrant rentals. After these marked reductions, the water-works system has been so operated that the report for the year ending June 30, 1927, indicates that the revenue from the sale of water is sufficient, not only to maintain and operate the water and sewer systems, but to meet annually the interest and retirement of the first $100,000 of the 1927 bond issue. It is thought that within three years the interest and retirement of the other $100,000 issue can be met by the water rentals.

The Oxygen Demand of Polluted Waters

With a persistence which entitles it to front rank among hygienic fallacies, the idea has long clung to the popular mind that running water, if not always pure, will at least purify itself "in a dozen miles or so." Disastrous consequences following too literal application of this erroneous principle to the selection of municipal water supplies has prompted numerous scientific investigations both here and abroad. A critical review of these researches with a bibliography of over 170 references is given in Part I of a publication entitled "The Oxygen Demand of Polluted Waters," by Chemist Emery J. Theriault, recently issued by the United States Public Health Service as Public Health Bulletin No. 173. Part II of the same bulletin is devoted to the presentation of an extensive series of experiments conducted in the stream pollution laboratories of the Public Health Service. Public Health Reports reviews the bulletin as follows:

Briefly, it may be stated that a water contaminated with the organic matters found in sewage and in various industrial wastes does gradually rid itself of such pollution if allowed free access to air. Early studies of this phenomenon of self-purification led to the abandonment of a plausible theory based on the direct action of oxygen on the organic matters, and subsequent research extending over the past 50 years has revealed that the self-purification of streams is essentially a biological process. In this sense the oxygen contained in aerated or running water does not operate as a sterilizing agent, as once believed, but rather as a neutralizing or deodorizing agent for some of the gases resulting from the bacterial decomposition of the organic matters. Dissolved oxygen is also required for the maintenance of fish life. While thus relegated to a secondary rôle, the amount and rate of disappearance of the oxygen which is contained in a given water nevertheless serves as an excellent indicator, first of the threatened disappearance of fish life and, with increasing pollution, as a warning of impending nuisance conditions. With the understanding that a bacteriological examination is a much better index of wholesomeness or fitness for drinking purposes, it has accordingly become customary to express the pollution of a given water in terms of its demand for dissolved oxygen when reference is made to the threatened disappearance of fish life or to the approach of nuisance conditions.

On the basis of extensive series of observations presented in Part II of Public Health Bulletin No. 173, it has become possible to give numerical expression to the actual rate at which the oxygen demand of a water is satisfied. The outstanding feature of this section of the report is that the rate at which the organic matter is oxidized, while strikingly uniform with a variety of waters, is exceedingly slow. Thus, in a given experiment with Ohio River water collected at Cincinnati, oxygen continued to be used up for fully 300 days and bacteria of intestinal varieties persisted for almost that length of time. Even in the absence of intervening pollution, it would be necessary to allow for a stream flow of several hundred miles before a water, once polluted, could regain its pristine purity. Irrespective of distance from the nearest upstream point of known pollution, it may be safely stated that no river in the United States can now be regarded as hygienically safe without treatment. Conversely, the possibility that a water polluted with sewage might be fully purified by flowing for "a dozen miles or so" becomes too remote for serious consideration.

From a more technical angle, the bulletin under discussion includes data relating to the rate of deoxygenation of polluted river water from which the velocity constants and the temperature co-efficient of the underlying biochemical reaction have been computed by the least-squares procedure. The orderliness with which the reaction proceeds compares favorably with that of the purely chemical reactions thus far reported in the literature. This constancy of the rate of deoxygenation of polluted waters is also borne out when the oxygen demand values obtained at various cities are referred to a per capita basis. For the average community, the amount of oxygen required each day for the stabilization of its carbonaceous wastes will be in the neighborhood of 100 grams (0.22 lb.) per capita. The findings in this respect are of especial significance, inasmuch as they indicate the possibility of making fair estimates of the ability of a stream to withstand pollution without giving rise to offensive conditions, by a calculation based solely on the contributing population and the volume of stream flow, and without resort to expensive laboratory investigations. Similarly, it would appear possible to estimate the minimum requirements in regard to the treatment of community wastes for the purpose of relieving existing nuisance conditions. The per capita oxygen demand figure also enters into several other sanitary engineering computations.

Analytical and statistical methods of procedure are given in the four appendices.

This bulletin may be purchased through the Superintendent of Documents, Government Printing Office, Washington, D. C., at 25 ct. per copy.

A New Pull Shovel Skimmer Scoop

The Northwest Engineering Company, 28 E. Jackson Blvd., Chicago, announces a new pull-shovel skimmer scoop. This new machine is confined to the Model 2 and Model 3 sizes. Their design is said to introduce some new features for handling grade.

The design is novel in that the same boom is used for both pull-shovel and skimmer. A shear leg hinged to the machine can be tilted forward or backward by the boom hoist. This is said to permit a micrometer adjustment of the boom which is intended to give greater depth of cut with the pull-shovel and permit cutting with a flat boom the full length of the cut with the skimmer.

The boom is a true box section consisting of ship channels welded top and bottom with heavy plates. The same dipper can be used for both machines as it is easily removed from the pull-shovel stick and attached to the carriage of the skimmer, according to the manufacturers.

The boom head design permits running the dipper teeth beyond the boom point, it is claimed. The dipper is heavy and of the bottom dump type and due to its open throat has a high capacity, according to other claims that have been made.

To convert from one type of machine to the other it is only necessary to make six minor changes and re-reeve the cables, say the manufacturers.

An Interesting Water Power Development

Construction Views of Deer Rips Development of Central Maine Power Co., on Androscoggin River, Maine. Morton C. Tuttle Co., Boston tractor; Frank Creedon, Superintendent of Construction

(1) Sounding for Upstream Cofferdam. (2) Getting Ready to Unwater Cofferdam. (3) Aggregate Pits—Cement Shed at Ieft. (4) Power House Pit. (5) Placing Concrete. Concrete Brought from Mixing Plant in Car. Dumped into Bottom Dump Bucket and Swung into Pit. (6) Excavating Inside Cofferdam. (7) View Looking from Tail Race Across Power House Site Where New Flume Will Cut Through. (8) View of Excavating Operations, Showing Shovel, Crane, Scale Panfrom Power House Pit and Spoil Cars.

Any bit of construction of any size today becomes very much an equipment problem. The accompanying photographs taken at the Deer Rips development of the Central Maine Power Company show a considerable variety of equipment used within a small radius.

The development consists of a new power house to take a 5,500 H. P. unit, with a new flume and intake and new tail race, the dam being already in place, and serving a power house on the opposite shore.

Before the tail race section was unwatered the bottom was reported to be ledge, but when the coffer was built it was discovered that there was a considerable overlay of loose boulders and earth. As a consequence a Marion steam shovel and a Northwest crawler gasoline crane with dragline were put into the excavation. The spoil, both loose and ledge not used for coffer loading, including that swung out of the power house pit by the derrick, is hauled down the river on the spoil railway in Easton dump cars hauled by Plymouth gasoline locomotives.

Due to the decision to use washed aggregate and the knowledge that much of the concrete would be poured in winter weather, a large quatity of aggregate was shipped in immediately and so piled as to fit in with the plans for operating. The cement shed is placed within reach of the same derrick which will handle the aggregate into the hopper of the mixer plant so that a scale pan of cement bags may be dropped through a trap door, to the mixer platform level. The bin and plant and the water tank will all be heated from a nearby boiler. The hoisting house is glazed so completely that the hoist man can see the whole operation and not need a man on the bull wheel.

On the bank adjacent to the rock work are set up the compressors and blacksmith shop. The carpenter shop is located where the shaped forms are to be built. Materials are hauled in to the job on the company's standard gauge siding.

A 3,185 Gal. per Minute Well Test.—A test made by the Roxana Petroleum Corporation on a porous concrete well at its refinery at Ward River, Ill., is stated to have shown a production of 3,185 gal. per minute. The test was made by a deep well pump driven by a steam turbine in a well 26 in. in internal diameter for a period of 16 hours. At the end of this period a "draw down" test was made while the pump was working on a capacity of 3,185 gal. per minute, and the water in the well had receded 13 ft. 11 in. below static level.

Street Opening and Widening Improvements at Los Angeles, Cal.

Their Effect Directly Reflected in Form of Increased Values of Abutting Property

By JOHN C. SHAW
City Engineer, Los Angeles, Cal.

THE city of Los Angeles, like many other cities, is faced with an extensive program of street opening and widening development, in order to provide for constantly increasing vehicular traffic. The opening of new main highways and the widening of existing highways is of unquestionable benefit to the general traveling public. This form of improvement, is, however, a matter of considerable concern and conjecture as to whether the effecting of new improvements of this character is directly reflected in the from of enhanced values to abutting property, at least to the extent of the cost of the improvement, in which event the improvement may be regarded as a sound business investment.

Effect of Widening in Residential Section.—This feature of increased values, in some cases, may or may not apply, particularly where a street is widened which traverses a highly developed residential section. It can readily be seen that the forcing of a greatly increased volume of traffic along such a street may, in some cases, be detrimental. If we consider the development, and use to which the property along the street is put, the forcing of traffic through such a district might tend to break down rather than improve the conditions of the district in general. We have some instances of this kind in this city. One, particularly, occurs to me, that of a beautiful avenue, some ten miles in length, most of which traverses strictly residential property, and highly improved in this respect. In some cases, of course, it is impossible to prevent the breaking up of residential districts, particularly if such districts lie within or adjacent to sections rapidly changing as a result of the encroachment of business and apartment buildings. This is especially true if the proposed widening has been planned in advance and is a part of the general traffic plan.

The Policy at Los Angeles.—In the past few years, this city has adopted a policy to the effect that in cases where new highways are to be opened or widened at a width of either 80 or 100 ft., or more, the same are, to a certain extent, of city wide interest and importance, and therefore merit a contribution from public funds of a portion of the cost of effecting such improvement, the proportion of such allocations ranging from 10 to 20 per cent of the total estimated cost. The remaining cost is assessed against a local district, embracing such territory as may be regarded as directly benefiting from the establishment of the new highway.

In the case of this city, a comprehensive plan of highway development covering the entire city was adopted by vote of the electors in 1924, based upon a careful study of the present and future traffic requirements. A limited number of these projects, regarded as of most value to traffic, have been selected for immediate consumption, and the remaining projects will be worked toward in conection with the future growth and traffic increase, and taking into account the extent of such a program that the city is able to finance at one time.

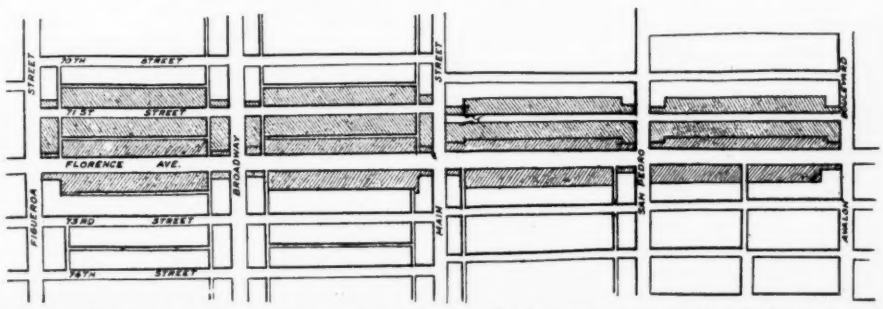
The Widening of Florence Ave.—The case of Florence Ave., in this city is cited to show the effect of a main highway widening upon the values of the adjacent property. This street is included in the major traffic street plan of Los Angeles, previously referred to, but the widening proceedings were initiated in the year of 1920, or four years in advance of the adoption of the general plan. The section of Florence Ave. referred to is one mile in length, between Figueroa St. on the west and Avalon Blvd. on the east. It follows a section line and is located about five miles southerly from the heart of the present retail business district of the city. Previous to the institution of the widening proceedings, Florence Ave. was 60 ft. in width, and was widened to a new width of 100 ft. by the acquiring of 20 ft. strips of private property along each side thereof. As a matter of comparison of property values, the case of 71st St., which parallels Florence Ave., one block northerly, is also cited. This street is 60 ft. wide, or the width of Florence Ave. previous to widening.

Increased Assessment Valuation.—The following tabulation indicates the aggregate assessed valuation, taken from the county assesor's rolls and made for the purpose of local taxation, covering both of these streets for the years 1920, 1923 and 1927. 1920 is the year in which the opening and widening proceedings for Florence Ave. were first instituted by ordinance. 1923 is the date of the completion of the condemnation suit. The paving of the street, as widened, was completed in 1926.

	1920	1923	1927
Florence Ave.	$70,780	$138,510	$366.010
71st St.	$59,290	$113,950	$198,020

The actual value or selling price of the property is from 2½ to 5 times the amount of the assessed value as represented by the above figures. During the period from 1920 to 1927, the increase of all property fronting on 71st St., as indicated upon the accompanying map, was 340 per cent, and on Florence Ave., the property value increase amounted to 520 per cent.

What an Analysis Shows.—An analysis of the above figures would indicate that 71st St., one block removed from Florence Ave., has been subject to more than the normal property value increase due to its proximity to the street actually widened, and that in the case of Florence Ave., the similar increase in values of 520 per cent clearly indicates that such increases is directly traceable to the effect of this widening improvement. The adjacent property owners along Florence Ave., who paid the major portion of the cost, are highly pleased with the improvement. This street, which a comparatively short time ago, was a country lane, with a few old time residences along the same and a little business activity at the principal corners, has become a



Map Showing Location of Florence Ave. Widening Development and Property Affected by It

main highway, with a roadway paved 74 ft. between curbs and a system of ornamental lights installed along the same. Traffic has vastly increased and business establishments are springing up, not only at the corner, but also along a considerable proportion of the inside lots.

The above county assessor's figures do not represent the total increase in values along this street, as the assessor follows a policy of being somewhat conservative in the making of too radical changes in property assessments, rather allowing the property a little time to develop its potential possibilities before immediately subjecting it to a high tax rate, so that the actual increased values are far in advance of those quoted herein.

From the experience of the above street, and this applies also to many other streets where like improvements have been made, the consumption of this necessary public improvement was a sound business investment to the property owners themselves.

Stone Roads

Suggestions Given in Paper at 14th Annual Purdue Road School

By C. W. McCLAIN
District Engineer, Indiana State Highway Commission

I WILL give a few suggestions to road men having in charge the maintenance of stone roads who do not have access to a testing laboratory.

Selecting the Material.—All good road metal starts at its source. No testing laboratory is necessary to detect objectionable shale, soapstone, and sandstone. This can be done at the quarry by anyone having even a rudimentary acquaintance with limestone. Two qualities almost always spoken of in laboratory tests of stone are hardness and toughness. These at first thought may seem like confusing terms, yet one quality without the other makes for poor road metal. Every road is constantly being subjected to a grinding action, either from the action of steel tired vehicles, or the rubbing action of one stone on another. In order to resist this grinding action the stone must possess the quality of hardness.

The surface is also subjected to pounding and impact action which tends to break up the metal into smaller pieces. In order to resist this action the stone must possess the quality of toughness. Remember the two destructive actions, grinding and breaking. A hard stone may be so brittle as to be almost useless and a tough stone so soft it will readily grind into dust. With these in mind a very good visual and manual analysis can be made of road metal. Take some section of your stone roads that holds up exceedingly well and see if you do not notice these two qualities prominent.

Another thing to be looked for is the cementing value of the stone. A road that won't pack or one that grinds up into dust are both objectionable. If the proper hardness and toughness are secured this cementing property will take care of itself. If you have a road that ravels or one excessively dusty look for the remedy in the quality of your road metal. No set rule can be laid down for this selection but experience and close study are neecssary for results.

Placing the Metal.—After the proper material has been selected the next thing is to get it on the road. I am sure all of you have seen the wrong way to dump road material on the road surface. The common practice used to be, and I am sorry to say, in some places still is, is to dump the whole load in one place. The next load is done the same way, usually leaving 2 or 3 ft. between the end of one load and the beginning of the next. I think nothing need be said about the riding qualities of such a road. The metal should be uniformly and evenly scattered. If the base is strong enough remember you are only replacing the wearing surface by the addition of metal.

The stone should always be put on at such times of the year when it will readily incorporate with the surface. Recognition of this one fact alone will save many dollars in road metal and your road will correspondingly grow better. One yard of metal up where the traffic runs is worth many yards along the edges, on the shoulders or in the side ditch. Where you dump the metal is usually where you want it, so every advantage should be taken to keep it there.

If put on at the proper time a larger aggregate can be used. By this use of larger sizes a sturdier road will result. If the surface is not in the proper condition to receive a larger aggregate and it is put on, it will roll around on top and be very objectionable.

The principle of dragging and planing is so well known among all road men I am purposely omitting any further mention of it. The best way to have a smooth stone road is to keep it smooth. Once a stone road surface gets rough it is difficult to get it back in good condition. Great care should be taken that all stone surfaces go into the summer in a smooth condition. During the summer months a stone surface gets almost concrete-like in hardness and a drag or maintainer cannot have the smoothing action it would have on a graved road. A stone surface is not so subject to "chatter bumps" as is a gravel road. This is one of its advantages.

While many good qualities, the stone surface has some objectionable features. In summer the dust is very objectionable, both to the travelers' comfort and safety, and to the people living along the road. The farmers' crops, especially his forage crops adjacent to the road, are practically ruined if a rain does not immediately precede his harvest. The dust will penetrate into the houses and cause housekeepers much annoyance. While not holding a brief for any particular type of road, I do know that the presence of stone in my district has kept many miles of roads out of the mud and in good driving condition, where otherwise these same miles of good roads would never have been built.

In conclusion remember that stone can make an excellent road if properly selected, applied and manipulated. Have clearly in mind what you want when selecting your quarry, the condition of your road when applying the metal, and forecast the season's demands when manipulating it. Remember a stone road going into the summer as a smooth road is more apt to stay smooth. Finally if a road is smooth, as far as the traveling public is concerned, many other defects are readily forgiven.

Adequate Lighting Would Double Night Use of Roads

Two per cent of a state highway investment if spent for adequate illumination would double the night use of roads and largely increase the usefulness of highway systems, according to an article in the Transactions of the Illuminating Engineering Society.

"Two knotty traffic problems which become more insistent every year are highway congestion by day, and glare by night. Adequate highway lighting would be at once the practical and economical solution of both.

"Let us consider this form an economic standpoint. The automobile investment of the United States for 1926 is estimated at ten billion dollars. It costs twenty to fifty thousand dollars to build a mile of highway. To light it costs about seven hundred dollars a year.

"On a basis of thirty-five thousand dollars a mile cost, for 2 per cent of the state highway investment, spent in adequate highway lighting, it is conservative to estimate that the night use of roads would be doubled. Night traffic is now 18 per cent of the total, and doubling this would increase the present efficiency of the highway system by at least that percentage."

Paving Work in Iowa Cities in 1927.—Sioux City occupies first place among cities of Iowa in respect to the amount of paving construction work done in 1927. Figures for the highest cities follow: Sioux City, 335,414 yd.; Clinton, 123,180 yd.; Burlington, 88,508 yd.; Ottumwa, 65,731 yd.; Davenport, 63,367 yd.

Management of a Municipally Owned Water Works

Practices and Principles Outlined in Paper Before Kentucky-Tennessee Section Am. W. W. Assoc.

By FREDERICK W. ALBERT
Engineer in Charge of Water Department Knoxville, Tenn.

THE maintenance and operation of a system of water works handled as a purely business proposition, requires essentially a business management, not overlooking the purely technical or scientific considerations, which are necessarily a part of such a business. The questions involved do not relate solely to the sale of a commodity supplied in the form of a water service, but also deal with the quality of the water supplied and the design, construction and operation of the physical property, by and through which the service is rendered.

Every organization has four basic departments—they are Financial, Sales, Production and Record Departments. These units should remain distinct, but their efforts should be so co-ordinated as to bring about unified results.

The Keynote of Management.—The keynote of management is unity of purpose—working together in mutual dependence for a single result. The best organization is that which brings about the closest co-operation among the departments.

There are four principles underlying all organizations—

(1) Management must have a head, be it one man or a formal planning department.
(2) The organization must furnish necessary information to intelligently plan; they must get facts.
(3) Each workman in each part of the organization must be given all conditions and facilities which he needs to carry on his work.
(4) The workmen must be secured, trained and handled.

Organization Is Absolutely Impersonal.—Let no man become indispensable. Shape your men to the organization, and not your organization to the man. Let no man be able to become indispensable to the organization, and so by his absence, through sickness or intent, tie up the work. Understudies should be trained for every important position, even up to the head, so that the work can be carried on in any emergency.

A chart showing clearly the line of authority and responsibility of each individual in an organization will go far toward removing many interdepartmental jealousies. The chart should be so simple that it is self-explanatory upon investigation. Each man's position is thus made perfectly clear and he easily informs himself as to what course to take when transacting business with other departments.

The Corporate Organization.—In the background and as the real force behind each municipal organization we have accountability to the electorate. Those of us who work in municipal organizations realize that each voter considers himself a very large stockholder in the municipally owned plant. Because of numbers, it is impracticable for the electorate to exercise individual control, consequently it delegates this at election time to the councilmen, aldermen, or other candidates fulfilling the function and duties accorded these officials, or to the commissioners who have the department in charge. In the former, the councilmen then elect a mayor or city manager. This group of the electorate, council, mayor or city manager, comprise what is referred to in this paper as the corporate organization.

The First Duty of the New Manager.—The first duty of the new head of the department is to familiarize himself with the records and operations of the department. Usually this takes considerable time, and necessitates first-hand investigation on the part of the new manager.

Diagrams or charts prepared as a result of these preliminary surveys will frequently develop the weak spots as well as the strong points in the organization.

He is now somewhat prepared to form a policy of procedure which while designed to produce the desired end, and the best results at the greatest economy in time, labor and cost, should be so framed as not to be accomplished at the sacrifice of his organization. In many instances, the end cannot be attained in a brief period and must consume months, and in some cases, years to effect the changes desired.

Having determined on his policy, as advised by his superiors or from his own knowledge of what is best, and having organized his department on paper, at least in the form of a chart, the manager of a municipally owned water works is invariably confronted with the difficult problem of procuring suitable personnel with which to work.

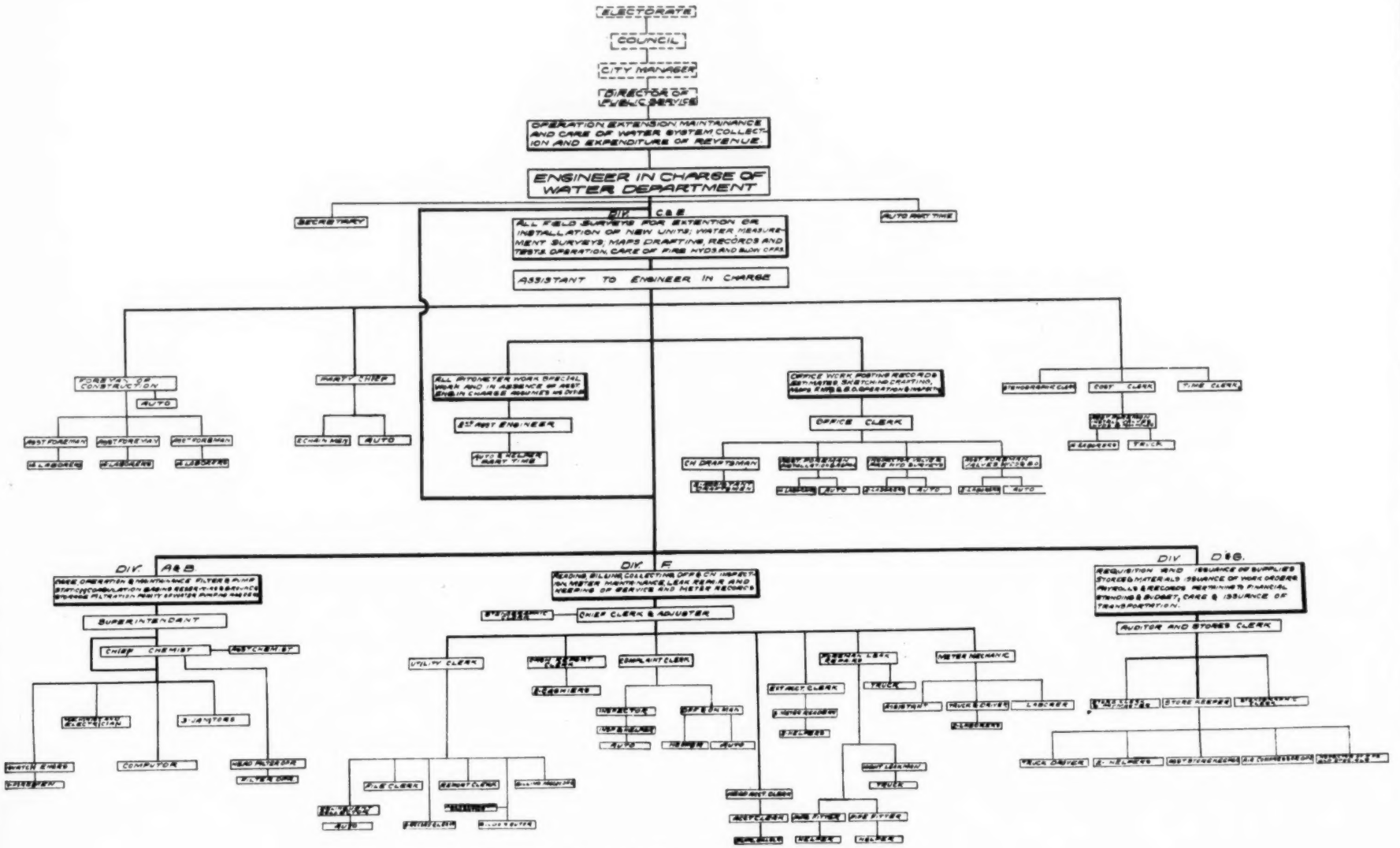
The Old Employees.—There are very few cases on record where the department does not have within its organization a number of old employees who should be pensioned, having given practically their lives in work for the department, but whose methods or attitude are entirely out of step with the march of progress of today. These employees are protected either by civil service conditions, or by a sense of fairness on the part of the manager, who believes that these employees have a right to consideration and employment after so many years of continuous, faithful service. In either case, they cannot be summarily dismissed, but frequently have to be used by the manager in his endeavor to carry out his policy of reorganization and efficient operation.

Regardless of the disposition of these old, inefficient employees, the manager must conduct himself and the department, especially in the early days of his office, in such a way as to develop respect, and a spirit of co-operation among the employees. No organization can live long, without the high cost of frequent labor turn-over, which does not possess these fundamental requirements of respect and co-operation.

The Division Heads.—Having selected his division heads (a process not without its hazards through political influences—the traditional "It never has been done that way" and other elements) the manager now has begun on his organization.

With each division head he must carefully go over the operations peculiar to that division and obtain, if possible, from the division head, recommendations of organization and conduct of employees, as well as operating practices and conditions, which are not only scientific, but efficient, economical and satisfactory. The most successful manager will be able to draw recommendations out of his division heads which incorporate the manager's ideas, but allow the division head to feel that the thoughts and suggestions are his own. If this can be accomplished, the battle is half won, for the necessary action will then be taken with an energy and force otherwise impossible to develop.

Employment of Outside Experts.—These betterments ofttimes require the employment of experts not a part of the organization. The division charged with the reading, billing and collecting will more than likely need to have its entire system replaced to obtain the


ELECTORATE
COUNCIL
CITY MANAGER
DIRECTOR OF PUBLIC SERVICE
OPERATION EXTENSION MAINTAINANCE AND CARE OF WATER SYSTEM COLLECTION AND EXPENDITURE OF REVENUE.
ENGINEER IN CHARGE OF WATER DEPARTMENT
SECRETARY
DIV. C & E
ALL FIELD SURVEYS FOR EXTENTION OR INSTALLATION OF NEW UNITS; WATER MEASUREMENT SURVEYS, MAPS DRAFTING, RECORDS AND TESTS OPERATION, CARE OF FIRE HYDS AND BLDG CRS
AUTO PART TIME
ASSISTANT TO ENGINEER IN CHARGE
FOREMAN OF CONSTRUCTION
AUTO
PARTY CHIEF
ALL ATOMETER WORK SPECIAL WORK AND IN ABSENCE OF ASST ENG IN CHARGE ASSUMES HIS DUTIES
1ST ASST ENGINEER
OFFICE WORK POSTING RECORDS ESTIMATES SKETCHING DRAFTING, MAPS ETC & G.O. OPERATION & REPORTS
OFFICE CLERK
STENOGRAPHIC CLERK
COST CLERK
FIRE CLERK
CH DRAFTSMAN
TRUCK
DIV. A & B
CHIEF OPERATION & MAINTAINANCE FILTER & PUMP STATIONS COAGULATION BASINS REMOVAL & REPLACEMENT OF SAND FILTRATION UNITS OF WATER PUMPING MACHINERY
SUPERINTENDANT
CHIEF CHEMIST
ASST CHEMIST
JANITORS
WATER ENGR
COMPUTOR
HEAD FILTER OPR
DIV. E
READING BILLING COLLECTING OFFICE & ON INSPECTION METER MAINTENANCE LEAK REPAIR AND KEEPING OF SERVICE AND METER RECORDS
CHIEF CLERK & ADJUSTER
UTILITY CLERK
COMPLAINT CLERK
METER MECHANIC
INSPECTOR
FILE CLERK
DIV. D & G.
REQUISITION AND ISSUANCE OF SUPPLIES STORES & MATERIALS ISSUANCE OF WORK ORDERS PAYROLLS & RECORDS PERTAINING TO FINANCIAL STANDING & BUDGET, CARE & ISSUANCE OF TRANSPORTATION.
AUDITOR AND STORES CLERK
STORE KEEPER
TRUCK DRIVER
HELPERS

Organization Chart of the Water Department of Knoxville, Tenn.

best results at the lowest cost. The employment, therefore, of specialists in this work will reduce the period of difficult transition, and smooth out the rough spots affecting the consumers, while at the same time the work is done at a reasonable cost. Such a re-birth is difficult under the best of conditions, and is especially high in potential trouble if the head of the division has old employees who have not had the training or experience to make the necessary revision, or if he has not the time to evolve the plans and steps required, while carrying on the normal activities of his division.

Similarly the engineer in charge of extension and construction may or may not be qualified to evolve plans for new structures and for the design of trunk and distribution mains, necessitating the employment of a consulting engineer whose business is along these lines. And so on throughout the department.

These professional experts, together with the director of law, director of finance, purchasing agent and other directors through whom the water department functions, comprise the staff organization of the water department.

The Line Organization.—The line organization consists of the heads of the divisions and other important officials actively engaged in the operations of the water department. As stated above, the corporate organization consists of the electorate, the council and mayor, or city manager, through whom the head of the water department reports and from whom he receives indications of the policies he is to pursue and the objects he is to attain.

While we are altogether influenced, and in many cases limited by the policies enunciated by and through the city manager, and the corporate organization, and while we look to the staff organization for professional advice and solution of technical problems, it is with the line organization that we, as water works men, are principally concerned.

Divisions of Line Organization.—In the absence of precedent the line organization can be divided so as to show the operations and functions of the various divisions and personnel, beginning with the source of supply and ending with the accounts division. Following this idea, division A in many plants would comprise both the filtration and pumping operation. In some, division A would consist of operations incident to the source, and supply, and division B, to those comprising the discharge of the product into the distribution system. Division C would logically incorporate the engineering operations, dealing with the work in the field. Related with this work would be division D, which is stores, and division E, which would be construction. Division F, reading, billing and collecting, while division G covers accounts.

In Knoxville, Tenn., we have combined divisions A and B, or pumping and filtration; divisions C and E, engineering and construction; divisions D and G, stores and accounts, leaving division F, reading, billing and collecting, the only single unit.

This obviously decreases the overhead through elimination of supervising personnel, and because of the limited size of the plant, permits consolidation and concentration of effort.

Duties of Division Heads.—The duty of the head of each division, under the direction of the manager, called either the superintendent, the engineer in charge, or some similar title, is to select and train competent, skilled, efficient personnel to the end that the department will operate as efficiently and economically as any private concern doing business of equal magnitude. This is highly essential as the favorite pastime of the electorate is to make comparisons with or without foundation, justified or otherwise, but always tending to show that the management and administration of the municipal water works is extravagant, inefficient, and generally calling for the discharge of those in charge, and proposing the substitution frequently of men entirely untrained and unskilled in the work.

Using the Inherited Personnel.—Thanks to the inheritance of old employees from previous administrations, not necessarily imbued with the highest of ideals of public service, protected as these employees are, either by civil service, or by length of service, the experienced manager and division heads under him will early establish the policy of attempting to use the personnel at hand until it proves unsatisfactory, for the very good and sufficient reason that first, it is good business to utilize the experience of those long in the service, their knowledge and understanding of local conditions, as well as their knowledge of the properties of the department, and second, because labor turn-over is very expensive.

If the personnel once appreciates that the manager is reasonable, fair and honest, and intends to give everyone a chance, there will be little trouble in developing the beginnings of an esprit de corps, loyalty and of lasting morale, which are the foundations upon which his success as a manager must be built.

Importance of Securing Confidence of Assistants.—In order to be successful, the manager and division heads must earn the confidence of their assistants and associates, for without this, they can never develop and get the co-operation from them which is necessary. Scientific policies, marvelous organization plans and high ideals will go for naught, without the wholehearted co-operation of the personnel under the manager and division heads. In view of this, it is desirable that the division heads carefully study the operations expected of each individual, and then after a detailed survey of the personnel, assign those best fitted to the task in hand. The policy of equal pay for equal work should be early established; the very thought of favoritism should be eliminated from all consideration and the general practice of advancement through the ranks should not only be promulgated, but adhered to. This, however, should not handicap the manager or division heads under him from employing men outside of the organization, either in the city or out of the city, to fill key or other important positions, if a careful study, a reasonable trial and a detailed analysis of the personnel in hand convinces the manager that such employment is for the best interests of the department and city.

The Development of Understudies.—Having not only organized his department on paper, but having now completed his organization through selection of the best available personnel, the manager and division heads should begin the development of understudies, or substitutes for all positions of importance.

It is entirely essential that no person should at any time get the idea that he or his position is indispensable to the successful operation of the department. Probably each of you have had experience along these lines, as it frequently centers around old foremen and old men at the pumping station and filtration plants. There are many cases on record of foremen who have purposely carried the distribution system and its valve operations in their head, with the intent of controlling the operations of the department through their employment, under such conditions as they may wish to impose.

Uniform Hours and Equal Pay.—Before leaving the question of personnel, the manager and his division heads, particularly if they are segregated from the rest of the city forces, will consider the question of hours and time. Insofar as practicable, he should prescribe the standards in practice in private industries in his community. He should neither set up factory hours, nor banking hours, but should take for his standard the hours of similar utilities operating in his community. If this standard throws his hours out of line with those observed by the other city forces, then the question should be discussed in detail with the city manager and other directors, but above everything else, he should endeavor to learn and put into practice, the policy of uniform hours, and equal pay for the same service, not only in his own department, but if possible, as it is affected by the operations of the other city departments.

Tools and Pumping Station Equipment.—Co-incident with his study of the personnel the manager, and division heads, should consider the question of tools and equipment with which the personnel are to produce the results and attain the end desired. The experienced manager, as well as the ex-

perienced division head, need only an opportunity to enable them to select the essential, modern, up-to-date tools and equipment designed to justify their cost and return to the manager, the department, and the corporate organization, more than $1.00 in result for $1.00 spent.

Many municipal water works are and will be for years to come, saddled with old, antiquated pumping stations. This fact should not prevent the manager from encouraging the recommendation that cost-reducing equipment be obtained, and in seeing that its purchase, with or without encouragement from the division head, is made. These devices range in importance and cost from proper firing mechanism to gauges and charts which if properly analyzed and used will enable the operator and his division head to show a tremendous saving, not only in coal, but in other supplies used in and around the pumping station and filter plant. Besides the usual pressure gauges, the station should be equipped with recording gauges for steam and water pressure, CO_2 and flue gases, and proper scales for coal, ash and feed water.

The same thought applies to the operation of the engineering and construction division, which probably has been run with a total disregard for the need of accurate records, organized and scientific installation of mains, valves and fire hydrants—their maintenance and upkeep. Here more money can be wasted through the purchase of unnecessary equipment than can possibly be saved, over a long period of time, unless the manager knows, and with the division head can determine where to buy and where to cut.

Labor-Saving Devices Important.—Regardless of what he cuts, he must equip this division with such cost-saving as well as labor-saving devices as wireless pipe finders, geophone, valve finders, recording pressure gauges, pitometers, surveying instruments, tapes, stakes, etc., and if the work is of such magnitude as to justify the purchase he should purchase motor transportation in order that not only the engineers, but labor personnel can be moved from job to job, with the lowest possible waste of time.

If his records are analyzed, the manager will early learn that it costs a great deal of money in waste and loss of time to move a crew, unless he so organizes his work as to effect the maximum use of his transportation, and thus eliminate the unproductive waste of idle hours and half-hours, which quickly run into figures.

Construction Equipment.—Depending upon the magnitude of the extension programs, the manager will determine on the wisdom of purchasing motorized air compressors, including tools such as caulking, drilling, spading and tamping; one or more trenching machines, designed for municipal operations; backfillers; dump trucks, and other motor transportation; pipe cutters and regular lead or leadite melting pots, as well as the ever present picks, shovels, hammers and other ditch tools. The manager may find that the economical operation of his department will require the purchase of an acetylene welding and cutting outfit and the operation of his own blacksmithing shop.

His purchase of such equipment can only be made after the manager has analyzed the local labor and contracting conditions, and has determined beyond a shadow of a doubt, that he can do the work at a lower cost to the city than if let out to a contractor.

Need for Stores Keeping Records.—Handling of stores should call for the most careful study, as all too often there is loss to the department in the holding up of work due to failure of stores to be delivered on the job at the proper time, and in the "disappearance" of stock, which often takes place. To eliminate this loss and effect the saving which he has a right to demand, the manager should require the issuance of stores on requisitions placed in the hands of the store-keeper in sufficient time to permit delivery to be made before the materials are actually required. This will necessitate proper stores-keeping records, preferably in the form of cards showing the maximum and minimum quantities to be carried in stock, automatically coming out for requisition of additional materials when the quantity in stock reaches the minimum.

The City Purchasing Agent.—In the vast majority of municipally owned water works, under the city manager plan of city government, all purchases not only for the rest of the departments of the city government, but also for the water department, are and properly should be made through a city purchasing agent. Requisitions from the manager of the water department to the city purchasing agent should be made in sufficient volume to take care of not less than three months', and preferably six months' operations, but in any event, in sufficient volume to obtain the lowest unit cost.

Unfortunately, most city purchasing agents are imbued with the ever-present idea of the lowest price, with the result that unless the manager can get the support of the city manager, he may be faced with the extravagant situation where he is called upon to use the lowest priced article regardless of the economy involved through adaptability, use, durability and the other elements which in the final analysis determine the lowest true cost. The manager will likewise encounter a disinclination on the part of most city purchasing agents to buy the equipment which the manager's training and judgment dictates that he should specify. His tact and diplomacy will early be brought into use in his endeavor to get what he knows he should have, over the purchasing agent's insistence that price is the sole basis on which all purchases will be made.

Savings by Buying in Large Quantities.—Frequently the manager, by placing requisitions for larger quantities, sometimes even yearly requirements, can effect savings not only through logical competition, but by including deliveries at times and places specified by the manager. There are many tricks of the trade similar to this which the manager can employ to bring about the savings which show not only economy, but efficient business management, not the least of which is in proper handling of his scrap pile.

It is surprising the number of dollars which are thrown away by unthinking operators through disregard of the proper collection and segregation as well as the sale of scrap, through competitive bidding. One instance is sufficient; most alum used in filtration work is delivered in bags. Through investigation it was early found that good alum bags could be resold to local consumers at prices which made the handling of this salvaged material quite profitable.

Source of "Hidden" Income.—But scrap is not the only source of "hidden" income. The manager who has the interest of his department closely to heart, will discover that often he can earn a "pretty penny" for the city by salvaging materials heretofore left in the ground. This requires figuring, for if recovery costs are greater than the initial costs, obviously he should leave the pipe and fittings in the ground.

In the reading, billing and collecting division, the tools and equipment needed for efficient and economical operation of that division of the water works, can be generalized under the heading of system, for in this division more than in the others, system counts.

After evolving a satisfactory, economical system of reading, billing and collecting, the manager will find that the economy of this division is greatly increased through the purchase of addressograph machines, billing machines, and adding machines, providing the unit cost per account handled monthly is low enough. This is determined, of course, by the number of accounts on the books.

Records.—This brings us then to the question of records. Many authorities believe that this unit of the work should be handled by a separate division. Such a policy may be satisfactory followed in large organizations like the national life insurance companies, but in municipal water works experience and practice has shown that each division is best equipped to maintain its own records. Obviously, it is the duty of the manager and his line organization to see that no records are duplicated.

Duties of Pumping and Filtration Divisions.—The pumping and filtration divisions in Knoxville, Tenn., are re-

sponsible for the supply, treatment, filtration and purity of the city water, as well as for all pumping operations incident thereto from the intake to the consumer. It further has the maintenance and care of all buildings and grounds used by the water department for plant. It also has charge of the operation, repair and maintenance of all reservoirs and standpipes; and collects, analyzes and files all records and data incident to these operations. The various charts from the reservoirs, and in the pumping stations and filtration plant, are daily collected, carefully gone over by the technical assistant to the superintendent of the pumping station and filtration plant, and the day's operations planned as a result of this study, in conjunction with the report on future weather conditions, the season of the year, etc.

Duties of Division of Engineering.—The division of engineering and construction prepares all projects for water main, valve and fire hydrant installation, maintenance or replacement; assigns this work to the various crews under the direction of the general foremen; follows up the actual installation to see that the map, card and file book records show the conditions as they actually are in the ground; makes pitometer and rate of flow surveys of water through the pipe in the distribution system, to show the carrying capacity of the various mains, and the requirements of trunk and feeder mains into the various sections of the city; organizes and directs fire hydrant and valve surveys to insure proper and satisfactory operation of these essential elements in the distribution system, as well as their existence, by posting map and card records in the office.

Stores and Accounts Division.—Division D & G, Stores Accounts, receives and issues on requisition all materials and equipment used by all divisions in the department; keeps card records showing a perpetual inventory of all stock; makes a monthly inventory of materials on hand and accounts for the distribution and consumption of stores to the end that the stores account balances each month; and is responsible for the preparation of all financial statements and records dealing with the operations of the department.

Reading, Billing and Collecting.—Division F, Reading, Billing & Collecting, is variously known as—chief clerk's office,—office of the water department, water registrar's office, or by one of a dozen or more other titles. This division keeps all records showing installation of service connections, not only private, but industrial and fire; of complaints and leaks; installations of all meters, their condition and maintenance; all applications for water service connections and monthly reads, bills and collects on the water consumed each month on each service, in accordance with the rates, rules and regulations of the department. It likewise is responsible for the repair of all leaks on service lines, the repair of all meters and makes all inspections of matters affecting the water consumer.

It is obvious that this mass of records dealing with the different subjects and different operations of the department could not be satisfactory kept and maintained by one central division without additional, and in my judgment, unnecessary personnel.

Monthly Reports on Division Operations.—In addition, each Division Head has constantly at his hands the necessary data and information required to make a complete and comprehensive report on the operations of his division each month. These reports are due on the desk of the engineer in charge on the 10th of the following month, and enable each division head, as well as the engineer in charge, or manager, to prepare his annual statement of the operations of the department at an early date after the end of the fiscal year.

Through a study of the Organization Chart of the Water Department of the City of Knoxville, Tenn., which accompanies this paper, it can be readily seen that the personnel needed in the management of a business collecting and spending $600,000 per year, is not very large, nor are there any duplications.

While the budgeting of the department is really co-incident and determines the personnel organization, a consideration of the Budget as a necessary element in the management of a Municipal Water Works, must be treated as a separate proposition.

Anticipated Revenue.—In all water departments under the city manager form of government, and in many under other forms of municipal government, the manager of the water department is called upon to furnish his superior officer, prior to the closing of the fiscal year, a statement of his anticipated revenue under the then existing rates, rules and regulations, for the ensuing year, together with plans for the expenditure of this revenue.

A vast majority of the municipally owned water works are self sustaining and by charter, or law, are obliged to live within their yearly income, while at the same time their revenue is not available for any other purpose or function of the city government. In some cases, however, this is not true, and the municipal water works is permitted, through the council, to float bonds covering various projects, or the water rates are so manipulated by the council as to provide additional source of revenue for some other department of the city government.

Budgetizing Revenue and Expenditures.—Considering then the majority, where a municipally owned water works lives within its revenue, the budgetizing of the revenue and expenditures of the department, as they apply to the coming year, is a very important duty of the manager.

The operating expense such as pumping and filtration costs, and reading, billing and collecting costs, together with the sinking fund and interest on floated or funded debt, are largely fixed charges. The remainder of the revenue is then available for extension and construction work, engineering, stores, and the accounting, incident thereto.

If the previous administration has made a pretense of keeping cost records, the manager is in a fair way to make an intelligent estimate as to the work he can do. If, however, these records are not available, his first budget at least, is largely a guess.

Cost-Finding and Keeping System.—Under these conditions, one of his first duties, insofar as practicable and advisable, in view of the cost entailed, is to develop, establish and incorporate a small and satisfactory cost-finding and keeping system. Without a great deal of expense the fundamentals can be developed and in a short period of time, the manager can know in a rough way, at least, what it actually costs to prepare and pump 1,000 gal. of water—what it costs to read, bill and collect the average account, as well as what it costs per foot for making water main installations, replacements, lowering and repairing, and the same information for valves and fire hydrants.

This information is particularly important as it applies to such work as has been, or may be done under contract, for one of the earliest arguments the manager will find himself engaged in, is in proving that a municipally owned water works can do its own construction work as cheap, and possibly cheaper, than if same is let out by contract. Of course, this is impossible if the tools and equipment in the hands of the manager are antiquated, inefficient or obsolete, for his activities must be based on the current practice of contractors and his tools and equipment must be on a parity with theirs.

Under the terms of its charter, a municipally owned water works must live within its current revenue and under no conditions is it permitted to create a deficit. It may accumulate a surplus for its own future needs, but if these are not approved by the corporate organization, then and only then should the surplus be used as a basis for a reduction in water rates.

The time comes, if the department has lived not only within, but up to its yearly revenue, when major extensions, improvements or betterments, must be made. These should be taken care of preferably through the establishment of a reserve, if the rates, rules and regulations will provide a surplus and or if there can be reasonable assurance that such a reserve will be retained for the object it has been established to attain. If the rates will not permit of such a reserve, then the manager, through the city manager and

the council, must either increase the rates or float a bond issue to provide funds for such betterments.

When Rates Should Be Reduced.—Assuming the ideal when the department has, as a result of efficient, scientific management developed its distribution system to a point where it will take care of not only the present, but of reasonable future needs, and assuming that the headquarters, as well as the pumping station and filtration plant, reservoirs, and other property including trucks and equipment are in such condition that they will be good for present and future operations, and finally, where no reserve is needed, at such time and only then should the department declare a dividend and show its profits through a reduction of rates.

This day can be hastened if the department has been protected by law or ordinance against the uneconomical and unscientific practice of providing free water or free service to any consumer, including the city.

Free Water.—The rule has become more and more general, 1st, that there shall be no free water or free service to individuals, industries or other users of water and 2nd, that the city shall pay for water used for municipal purposes, including fire, street flushing, sewer flushing, hospitals, schools, jails, etc., and shall also pay a legitimate fire hydrant rental, and a fixed charge on miles of water mains larger than 6 in. in diameter. In other words, if the department receives pay for its services and in turn pays public utility taxes to the city, county and state, it has a right to demand of the taxpayers this return for the services it renders the city.

If these payments are actually made, as they are to privately owned plants, the profits and dividends which the municipally owned plant can declare to its stockholders—the water consumers—in the form of reduced rates, would be far more frequent and larger than they are now.

Cooperation with Other Departments.—A duty of the manager of a municipally owned water works, which is of equal importance to his organization of the water department is his obligation to so direct and conduct the affairs of his department that the relationships between the water department and the other city departments will be congenial, cooperative and mutually beneficial, for after all, personnel comprising the city government are employed and paid for the sole purpose of providing and giving to the inhabitants of the city, the best service at the lowest practicable cost.

Frequently, the manager will find that the city already owns and operates a municipal garage where other city transportation is stored and serviced. Oftimes, after the development of a mutual sense of obligation and desire to co-operate, he will find that he can save much money by storing and maintaining his motor transportation along with the other city owned vehicles in the municipal garage. The success of such a movement of course, depends entirely upon the intent of the superintendent of the municipal garage to treat each car and each department alike. Without that spirit, favoritism will early creep in and the water department will either profit or suffer, according to the influences and pressure which the manager or some other department director can bring to bear upon the garage officials.

Usually the health department in it's desire to create the best possible conditions leading to the good health of the citizens will make recommendations or demands on the water department which are extravagant and ill advised. The primary duty of the manager of the water department, is to co-operate with the health department and provide, wherever logical and practicable, all extensions considered necessary for the public health by the health department. This situation will generally pertain and the manager will seldom find it necessary to argue against the recommendations of the health department, excepting in abnormal and unusual cases.

The same applies to the fire department where the demands for additional fire hydrants, or mains of larger capacity to take care of unusual hazards are considered necessary by that Department.

The service, street and sewer departments are usually found to be source of greatest complaint by the water department through the unintelligent operation of fire hydrants and other connections through which these departments get water for their activities.

Ordinarily the supplies for schools and other departments operating in buildings, go through meters and are recorded and charged for in the course of the regular business of the water department.

It is obvious that these external contacts are with departments having fully as important functions as the water department and make life pleasant or otherwise for the manager, according to the spirit developed between the personnel of the departments. Consequently, tact, diplomacy and insistent requirements that his own associates shall so conduct themselves as to early develop good-will and co-operation through their contacts with the other Departments is one of the most important duties of the manager.

Cooperation with Other Public Utilities.—The same thought applies to the other public utilities. The power, Gas, light, telephone and streetcar companies are all in a position to help out and frequently are all very anxious to help out if the personnel of the water department will but meet their personnel half way. It is not a question of favoritism, or special privilege, but more generally a desire to live and let live and to help out in time of need.

The experienced water works manager knows that many times in the year, as the result of emergencies, the goodwill of someone of the other public utilities is essential to the continuous and satisfactory operation of the water department. The Golden Rule is a splendid motto to post, and a splendid ideal to attempt to live up to, for the manager who will "do unto the others as he would be done by" will get along much farther and much happier than the manager who follows the principle of "doing the other fellow before he does you."

Developing and Holding Good Will of Public.—In a sense all of the foregoing practices and principles set forth in this paper are but preliminary to the most difficult task which confronts the manager of a municipally owned water works, namely, developing and holding the good will of the public.

In 90 per cent of the cases, water consumers are called upon to pay either electric, gas or telephone bills. In the vast majority of these cases anyone or all of these bills is continuously in excess of the consumer's water bill. However, the consumer realizes that the other public utilities have to purchase their product in one way or another, while he contends the municipally owned water works gets it's product for nothing. Consumers never stop to think or understand that it costs money to locate sources of supply, to build structures and equip plants required to obtain, treat, purify and pump this supply nor that it costs a great deal of money to deliver the water supply to the consumer's front door. These costs are greatly in excess of the cost of the product of the other public utilities, but the consumer has only one thought in mind, that water and air, the essentials of life, were God-given and that water should be as free as air.

The fundamental objections to paying for water must be explained away and the consumer made to realize that the municipally owned water department is not operated for a profit but at cost, bearing in mind the maintenance and extensions necessary to take care of the future growth of the city.

Intelligent and Speedy Handling of Communications.—Many objections and much of the public criticism of the water department can be eliminated if the manager will insist that all communications from the public, whether verbal or written, be handled intelligently and as speedily as would be the case in any private business. After all, the water consumer is fairly reasonable and will be satisfied with an intelligent and serious reply, no matter how trivial his complaint or request.

Much good will can likewise be engendered by the proper use by department employees of the telephone. No greater source of misunderstanding has been invented than the telephone and

consequently, patience and intense desire to be of service, help and develop good feeling toward the Department must be deep rooted in the minds of all department employees coming in contact with the public over the telephone.

Experience has inclined many executives to the belief that women, neither too old nor too young, are best equipped by nature to handle this peculiar type of work, and their employment in these positions is becoming more and more general.

Most water departments control the payment of water accounts through the practice of shutting off the water in case of non-payment. Here again, even though the consumer knows that he is entirely at fault, his favorite indoor sport is in blackguarding the water department because his water has been cut off.

The selection of men employed to collect delinquent accounts, make inspection as to cause of high bills, and turn-on and off water service is of primary importance, and is but another example of where the man must be selected for the job, and not the job created for the man.

Complete understanding, co-operation and good will of the other departments in the city government, the other public utilities, and the public as a whole, is of utmost importance to the successful management of a municipally owned water works. Without this, the technical and administration success of an executive or manager, no matter how outstanding that may be, goes for naught.

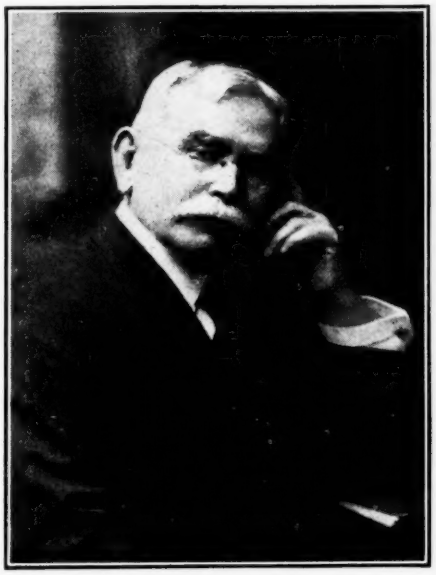
The management of a municipally owned water works is no sinecure. The position demands the possession in one individual of many rare qualifications, traits and characteristics. The happy possessor of all of these, who is still in the water works game is there because of his love of the game, and his desire to serve. There can be no other reason for his continuance in office, for the salary compensation is never commensurate with what he could earn in some other line of business. In spite of all this, there are very few of us who are charged with the operation of a municipally owned water works, who would be happy in any other service.

Daniel Kennedy

Daniel Kennedy, President of The Kennedy Valve Manufacturing Co., died at Hot Springs, Ark., on Jan. 14 after a short illness.

Mr. Kennedy was in his eightieth year, came to America from Ireland as a youth of seventeen, and was a self-made man in every sense of the word. In the trade as well as in his home city, he was highly esteemed and a leading industrial figure. He had the distinction of originating and for half a century guiding the destinies of a firm that is today recognized internationally as a pioneer and a leading builder in the valve, fire hydrant and pipe fittings field.

Mr. Kennedy's first business venture was in connection with the old Boston Dry Dock built in the Erie Basin, Brooklyn, N. Y., in 1877 and now owned by Robbins Dry Dock & Repair Co. Building of a dry dock of its size was a large undertaking in those days, with no bridges between New York and Brooklyn, few telephones or electric lights and no present-day power facilities.



Daniel Kennedy

The valve equipment for controlling the flow of water in and out of this dock was an important factor in its operation. In competition with designs submitted by valve builders of that period, those of Mr. Kennedy were chosen, and he was awarded the contract for building the gate valves in sizes ranging from 48-in. down, conditioned upon making the installation within given time and assuring successful performance. These valves, located at the bottom of a 35-ft. pit, were placed on time, met every requirement and even today are still functioning perfectly and to the entire satisfaction of engineers now in charge.

This contract established the firm of Daniel Kennedy with very small shop in New York City. The merit of the Kennedy designs and products was quickly recognized and the business grew to occupy a 4 story building. By 1890, greater manufacturing facilities were required and the plant was moved to Coxsackie, N. Y. The firm was then incorporated and the name changed from Daniel Kennedy to The Kennedy Valve Mfg. Co. Continued rapid expansion required a second move in 1907, at which time the present large modern plant occupying 20 acres was built in Elmira, N. Y. Many of the Veteran employees moved their families to Elmira in order to continue with the firm. In 1921, an additional 15 acre plant nearby was acquired for independent production of the malleable-iron pipe fitting lines which were introduced at that time.

The steady conservative growth of The Kennedy Valve Mfg. Co. was the consistent reward for Mr. Kennedy's tireless energy, ambition, natural resourcefulness and scrupulously honest dealing.

Many valve and fire hydrant design features of the now accepted general standards were orgiginated by Mr. Kennedy, and it is said that none of his designs ever had to be retired through failure in performance.

Mr. Kennedy's primary interests were in his family and in his business, to both of which he was conscientiously devoted. In private life he was of a retiring disposition and had an abundance of sterling qualities. His philanthropies were innumerable, but were carried out anonymously and with the reserve that was characteristic of the man. With his hundreds of employees, he enjoyed that popularity which is invariably courted by men in his position, but is often lacking. He knew many of his men personally, called them by their first names, and lived to see many of the sons and even grandsons of old-time employees grow up in his business.

Besides his widow, Mr. Kennedy is survived by three sons, Matthew E., J. C. and Clarence H., Treasurer and General Manager, Works Manager and General Sales Manager respectively of The Kennedy Valve Mfg. Co., and by three daughters, Mrs. John C. Judge of Brooklyn, N. Y., Mrs. Alexander H. MacCreery of Tulsa, Okla., and Miss Kathleen Kennedy of Elmira.

Phenol Wastes in Ohio River

The following resolution was passed by the Kentucky-Tennessee Section of the American Water Works Association at its annual meeting, Jan. 19-21 at Louisville, Ky.

WHEREAS, the discharge of phenol wastes into the Ohio River and its tributaries has endangered the water supplies of the municipalities using water from these sources, and

WHEREAS, the formation of the Interstate Stream Conservation Agreement of the Ohio River Basin, comprising the states of New York, Pennsylvania, West Virginia, Ohio, Illinois, Indiana, Tennessee, Maryland, Kentucky, Virginia, and North Carolina and the formation of the Board of Public Health Engineers of the Ohio River Basin has already resulted in elimination of the phenol discharge from fourteen of the eighteen plants formerly contaminating the waters of the Ohio River Basin with this waste and as the remaining four plants are now under orders from their respective State Health Departments to install means for eliminating phenol discharge from their plants on or before June 1, 1928.

BE IT RESOLVED by the Kentucky-Tennessee Section of the American Water Works Association in convention assembled at Louisville, Kentucky, January 19-21, 1928, that passage of anti-phenol legislation by the Congress of the United States is not necessary or desirable at the present time and,

BE IT FURTHER RESOLVED that this section approves and offers its help to the Board of Public Health Engineers of the Ohio River Basin in its efforts to accomplish the elimination of stream pollution of the Ohio River and its tributaries, as far as this pollution affects public water supplies.

Deep Well to Provide Water Supply for New Community

Contractor to Guarantee Pumpage for Thirty Years Under Purchase Contract

VILLA PARK, ILLINOIS, is a town of about 6,000 inhabitants some miles west of Chicago, and is a product of rather recent real estate development. Up to this present time this growing community has relied upon a number of shallow wells for its water supply, utilizing overhead tank storage, but this has finally proven inadequate, and a new and better source for water had to be developed. Investigation in neighboring communities disclosed that the most feasible source for water would be the sandstone formation known as the Dresbach or the Potsdam formation which lies at a depth of about 2,200 ft. from the surface. This formation has already been made to yield great quantities of water in other towns in the region, and is known to contain a pure water that aside from a hardness of about 20 gr. per gal, is of the best type for domestic consumption.

Lack of available funds, however, made it impossible for the village to undertake the drilling of a well to this depth and the erection and installation of the necessary building and equipment for the new waterworks, and recourse had to be secured to another plan. Acting upon the suggestion of the village engineers, the Edwin Hancock Engineering Company, Chicago, the engineers designed the desired system and bids were called for on the basis of the contractor installing the waterworks and retaining ownership for a definite period, selling water to the village at a definite rate, and agreeing not only to guarantee a definite pumpage, but to sell the waterworks to the community at any time for a price that varies with the year of purchase. The result was that the well is now being drilled by S. B. Geiger & Co., Chicago, and this company will construct the reservoir and pump house, install the equipment, and begin delivering water to the village mains by a fixed date. A description of the plan covered by the contract, and a description of the system being provided will prove of interest.

The Plan.—The contract approved by ordinance calls for the drilling of a 10 in. well to the lower Potsdam sandstone to a depth of about 2,200 ft., the construction of a 200,000 gal. covered reservoir, and the installation of adequate pumping equipment, etc. The

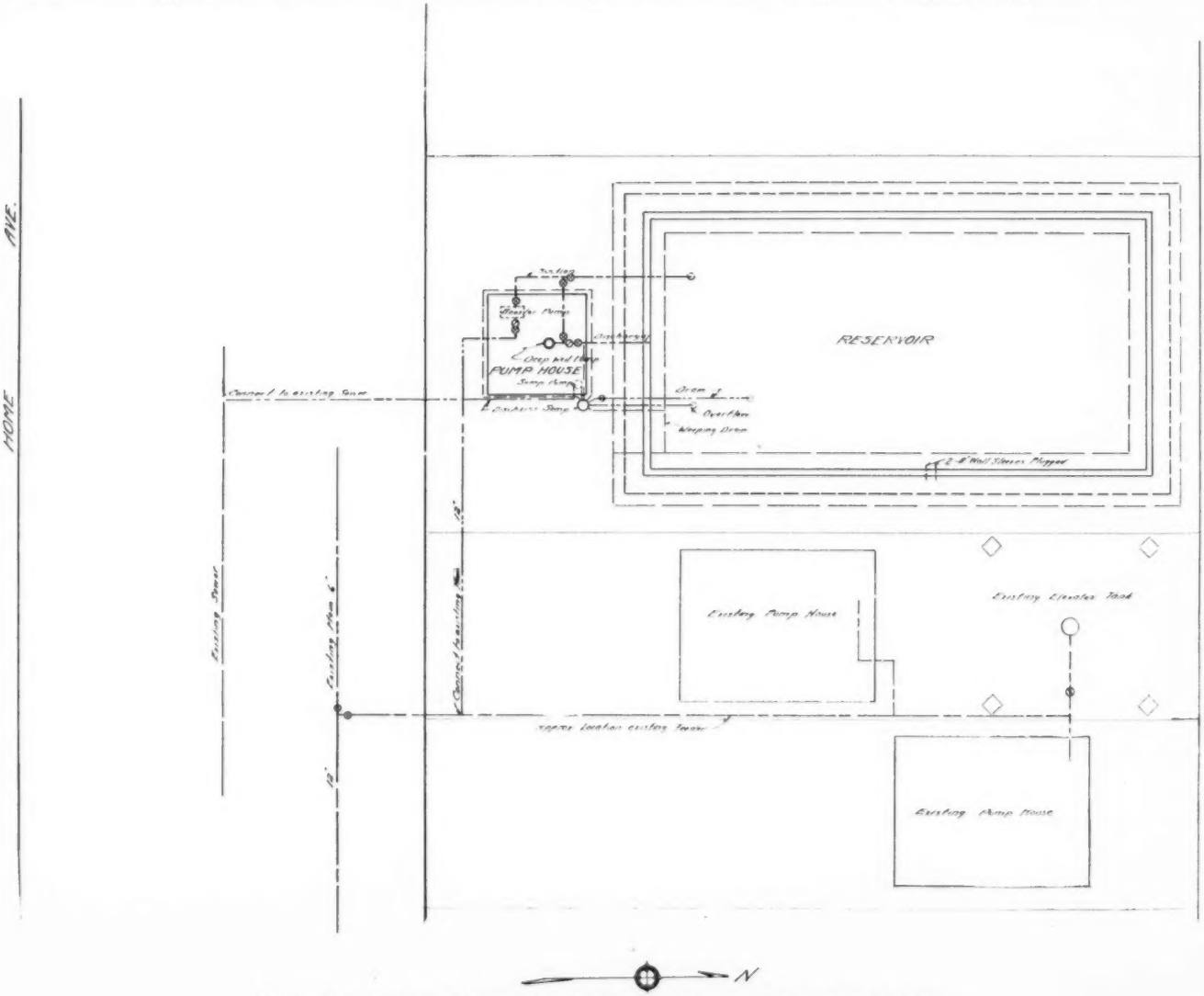


Fig. 1.—Plan of Waterworks, Showing Location of Equipment, Structures and Piping

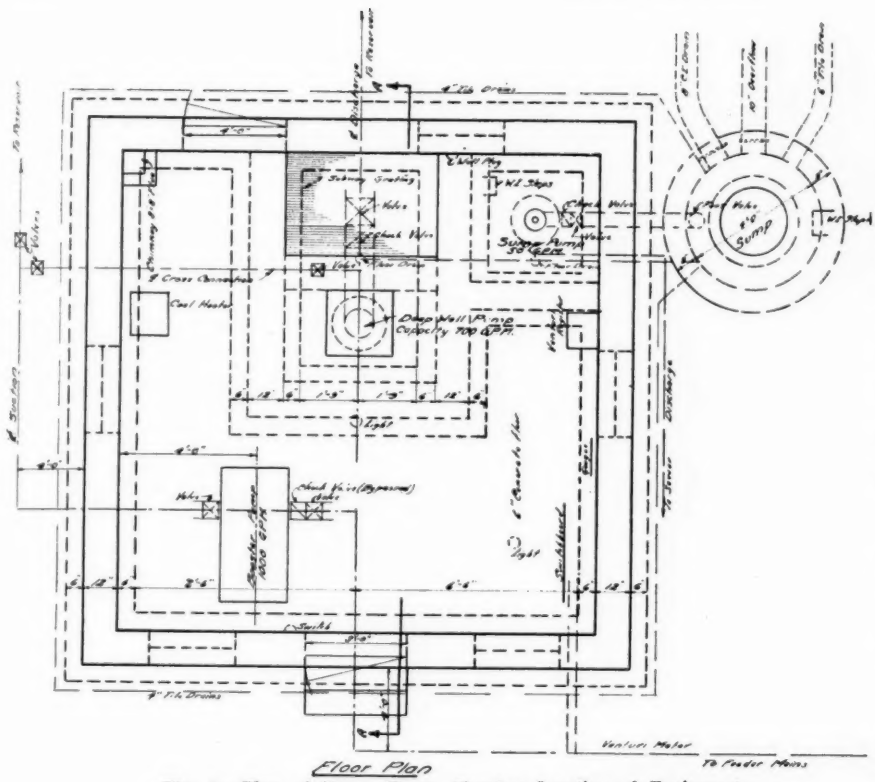


Fig. 2.—Plan of Pump House, Showing Location of Equipment

contractor is to bring in and guarantee a flow of not less than 700 gal. per min., throughout 24 hours per day, and must drill additional wells if the first or any succeeding well does not produce this pumpage. This pumpage must be maintained during the life of the contract, and if additional capacity is at any time needed before the expiration of the contract, additional wells are provided for at a specified price. The contractor also agreed to maintain the wells and plant throughout the life of the contract. By the terms of this agreement, the Village will undertake to buy all water produced, and to use water from no other source as long as water is available from this source, the plant will be operated by the Village, and the title will remain in the contractor until the work is taken over by the city in accordance with the terms of the contract. The contractor, during the terms of his ownership of the waterworks, will sell the pumpage to the Village according to a sliding scale of prices depending upon the pumpage per quarter. This ranges from 11 ct. per 1,000 gal to 13½ ct., depending upon the amount used.

Water Fund.—The Village is to create a special Water Fund, into which will be placed all proceeds from the sale of water to consumers, plus all money appropriated for the water system, and any other funds of this nature. Out of this water fund, the Village will pay the salaries and wages of employees in the water works, will pay for the power needed to operate the system, to pay the contractor quarterly for water purchased, (due 30 days after receipt of water taxes by the Village) and the surplus will be available for other use. The surplus is primarily to be provided for building up a fund for the purchase of the system. This purchase may be made at any time by the issuance of water certificates, water bonds, or water warrants, with a maturity of 20 years, and an interest rate of 6 per cent. The contract calls for the option to purchase at any time for the sum of $80,000 during the first 3 years, with the price decreasing thereafter after each five year period during the life of the contract. If the purchase option has not thus been exercised at the end of 30 years, the contract expires and the works become the property of the Village without cost. Under this plan, the contractor expects to make his costs and his profits from the salt of water should the Village fail to exercise the purchase option, while if the plant is purchased before the expiration of the contract, the contract will prove at least equally profitable to the contractor. Transfer of the real estate involved is included in the bargain.

Thus, through this plan, the community found itself able to obtain the needed water works even though there existed no corporate funds to be spent for such a purpose. The work of bringing in this guaranteed flow of first rate water is now under way.

The Well.—As already mentioned, the well is to be drilled to a depth of approximately 2,200 ft., into the Dresbach sandstone formation, and must be 10 in. in diameter at the bottom, and musct bring in a guaranteed flow of 700 g. p. d. The plan is to drill this well, using a standard churn drill rig, to a diameter of 20 in. for the first 500 ft., to reduce this to 15½ in. from this level to 1,100 ft., to further reduce the diameter to 12 in. until a depth of 1,600 ft. is reached, and to drill the rest of the depth at a diameter of 10 in. The

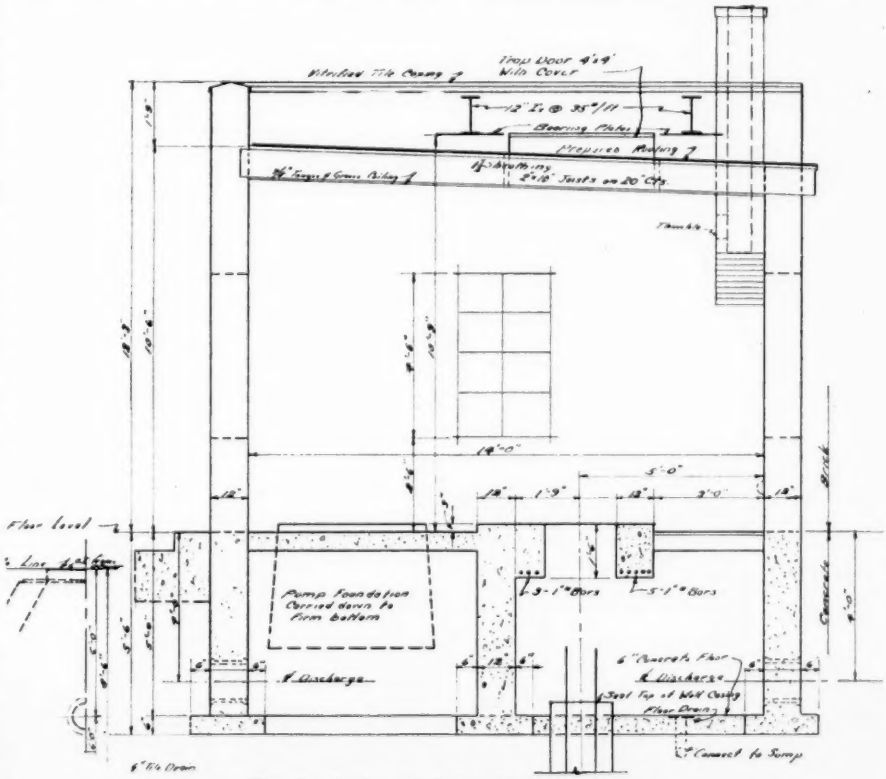


Fig. 3.—Section of Pump House Structure

formations that will be encountered, according to previous records, will be of interest.

The first 80 ft. will be of glacial drift formation, followed by Niagara limestone to a depth of about 200 ft., followed by 300 ft. of shale and broken limestone formation where the hole will have to be encased with an 18 in. wrought iron pipe. Next will come another bed of limestone to a depth of 740 ft., and then a bed of sandstone to a depth of 960 ft. From this level to a depth of 1,100 ft. a cavy formation of limestone will be found, and here the well will have to be cased with 12 in. wrought iron pipe. From the 1,100 ft. level to a depth of 1,250 ft. another strata of limestone will be encountered, and this will be followed by sandstone to a depth of 1,500 ft. This will be followed with 100 ft. of shale, which will be cased with 10 in. pipe. At this point the Dresbach sand or sandstone is encountered, and the well will be carried down through this strata to a depth of 2,200 ft., affording, it is expected, an adequate supply of water.

The Pump House.—The pump house, to be situated over the well, will be of brick construction on a concrete foundation. Its dimensions will be 16 ft. by 17 ft., with a height of 18 ft. The water will be pumped from the well by a deep well pump designed for a pumpage of 700 to 1,000 g. per min., and this equipment will be of the vertical direct-connected electrically operated turbine type working against a 385 ft. head. It will be situated in the well at a depth of 375 ft. While the static head is expected to be sufficient to bring the water to within 60 ft. of the surface, the water is expected to draw down to about 350 ft. while the pump is operated.

Reservoir.—The pump will deliver the water direct to a 200,000 gal. reservoir. This reservoir will afford sufficient surface storage in case of fire demand or other excessive demand or in case of possible breakdown of the pump. It will be covered with a wood roof and asphalt roofing, and the roof structure will be carried on wood roof trusses. This resevoir will be 40 ft. by 80 ft., and 10 ft. deep, and its bottom will be set 4 ft. below the ground surface.

Booster Pump.—The water will be pumped from this reservoir by a 1,000 g. p. m. booster pump, which will build up the pressure to 50 lb. from the 10 ft. head in the suction line and will pass the water into the existing 12 in. and 6 in. mains. The deep well pump is connected to this suction line in order that it may discharge into the mains if desired, using the booster pump to build up the pressure as above. Valve equipment is provided to permit the deep well pump to discharge into the reservoir or into the booster pump suction, while other valve equipment is proposed for both the suction and discharge sides of the booster pump. As shown in Fig. 1, this valve equipment consists of a gate valve and check valve on the discharge of the deep well pump to the reservoir, a gate valve at the T leading from this discharge to the suction of the booster pump, another gate valve at the T where this cross connection enters the booster pump suction, a gate valve between this T and the reservoir on the suction (To cut off the reservoir when pumping to the mains by the deep well pump) a gate valve on the suction side of the booster pump, and a gate valve and check valve on the discharge side of the booster pump.

It is of interest, here, to see that the mains are already connected to an existing elevated tank, and this tank will be of service in maintaining working pressures in the distribution system, and will furnish additional storage. This tank is said to hold 100,000 gal.

Sump Pump.—Drains and an overflow in the reservoir connect with a sump alongside the pump house. Inside the pump house, a sump pump will be installed to pump the water in the sump to the existing sewer nearby. This sump will be 4 ft. deep, and the sump pump will have a capacity of 50 g. p. m.

This water works will be so equipped that it will need but little attention. It will operate on purchased power and will be of the type often used in town and villages in the vicinity.

According to the engineers, the projected well should prove able to deliver almost twice the guaranteed pumpage, the life should be long, except for the reservoir covering, and this new water works makes a very good proposition for a community of this kind that cannot finance anything more extensive.

How They Built Roads in New Hampshire in 1792

It is significant that the expression "good old days," is never used with reference to highways, says the December issue of California Highways and Public Works.

But just how bad those days were, again referring to highways, never dawned upon us until the other day we began to delve in a history of New Hampshire of the date of 1792.

Here are some of the things that we discovered concerning highway building methods in that state at that time.

In surveying roads the length of a man's arm to every half chain was allowed for inequality of surface.

In view of the fact that few surveyors were skilled in finding the variation in their compasses by the sun's amplitude, it was proposed that durable monuments should be erected in convenient places on a true meridian, by which all surveyors should be obliged to regulate their compasses. The General Assembly voted down the proposal.

For crossing small streams beaver dams were found most convenient. New roads, therefore, were laid out to accord to the location of the dams built by those useful animals.

The expense of making and keeping roads in repair was generally borne by the inhabitants of the towns through which they passed, though in some instances roads were laid out at the public expense.

It was a custom for those who were at work on the highways to invite travelers to take a drink, and expect a gratuity in return. This custom, however, had largely been abolished in 1792.

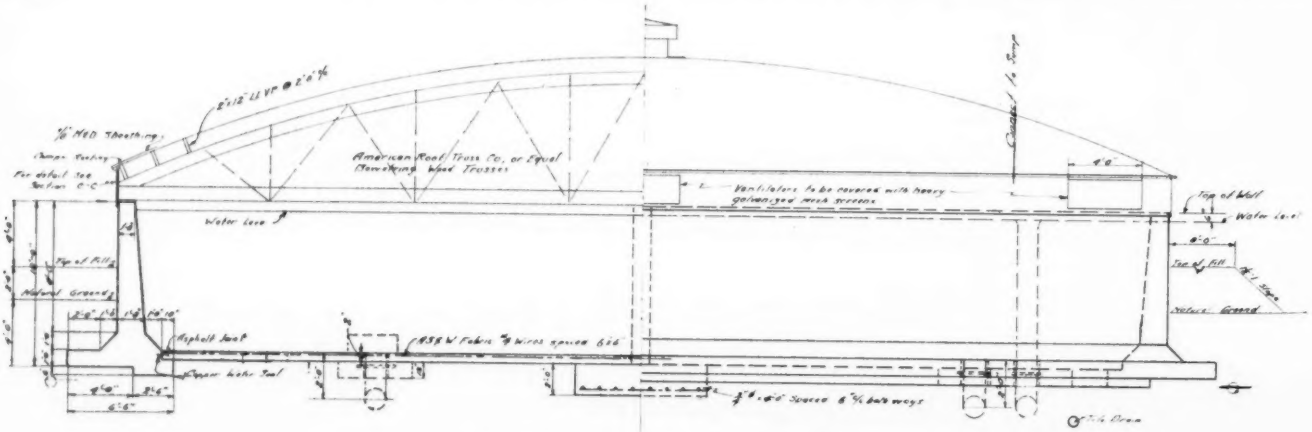


Fig. 4.—Section of the Covered Reservoir